Case Report

Correction of unilateral condylar hyperplasia and posterior open bite with proportional condylectomy and fixed orthodontic treatment

Sang-Woon Ha[a]; Jin-Young Choi[b]; Seung-Hak Baek[c]

ABSTRACT

A 29-year-old female patient with unilateral condylar hyperplasia (UCH) of the left side presented with facial asymmetry, maxillary transverse occlusal plane (MXTOP) cant, posterior open bite, and Class III relationship. Treatment consisted of proportional condylectomy of the left condyle for management of UCH, and fixed orthodontic treatment with intrusion of the left maxillary molars to correct the MXTOP cant and remaining chin point deviation (CPD). Proportional condylectomy with a 14-mm resection of the left condylar head improved the CPD from 11.5 mm to 7.8 mm and resolved the posterior open bite on the left side. However, it produced a Class II relationship on the right and left sides, posterior open bite on the right side, and anterior open bite. Fixed orthodontic treatment with 1.8-mm intrusion of the left maxillary molars using miniscrews corrected the MXTOP cant from 3.5 mm to 1.7 mm, reduced the remaining CPD from 7.8 mm to 3.7 mm, produced counterclockwise rotation of the mandible, and resolved the posterior open bite on the right side and the anterior open bite. After 16 months of total treatment, normal overbite/overjet and Class I relationship were obtained. Treatment results were well maintained after 5 years of retention. For the correction of UCH, it is important to determine the amount of condylar head resection and accurately simulate the correction of CPD and MXTOP cant through intrusion of the maxillary molars. (*Angle Orthod.* 2020;90:144–158.)

KEY WORDS: Unilateral condylar hyperplasia; Facial asymmetry; Posterior open bite; Proportional condylectomy; Maxillary molar intrusion; Orthodontic treatment

INTRODUCTION

Condylar hyperplasia is a pathologic condition that represents excessive growth and enlargement of the mandibular condyle and/or body, resulting in mandibular prognathism, facial asymmetry, or temporomandibular joint (TMJ) pain.[1] Women are more frequently affected by condylar hyperplasia than men.[2] Numerous etiologies of condylar hyperplasia have been suggested, including endocrine disorders (eg, insulin-like growth factors), metabolic hyperactivity, trauma, arthrosis, and genetics.[3]

Wolford et al.[1,4] classified condylar hyperplasia into four categories. Type 1 occurs through accelerated and prolonged normal condylar growth and can be divided into bilateral (type 1A) or unilateral subtypes (type 1B). Type 2 involves abnormal enlargement of the condyle caused by osteochondroma, accompanying compensatory downward growth of the maxilla. Type 3 and type 4 occur through benign and malignant tumors, respectively.

To correct condylar hyperplasia, it is necessary to consider its status. In the inactive status, conventional orthognathic surgery can be recommended without condylectomy.[1] However, in the active status, active growth potential of the affected condyle should be removed. For type 1, a high condylectomy has been performed to remove the upper 3 to 5 mm of the condyle, which is the most active growth part of the condylar head, for stopping the mandibular growth with a relatively small risk of side effects.[4–6] For type 2, a low

[a] PhD student, Department of Orthodontics, School of Dentistry, Seoul National University, Seoul, Korea.

[b] Professor, Department of Oral and Maxillofacial Surgery, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea.

[c] Professor, Department of Orthodontics, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea.

Corresponding author: Dr Seung-Hak Baek, Department of Orthodontics, School of Dentistry, Dental Research Institute, Seoul National University, Daehak-no #101, Jongro-gu, Seoul, 03080, Republic of Korea
(e-mail: drwhite@unitel.co.kr)

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Figure 1. Facial and intraoral photographs taken at the initial visit (age 29 years, 2 months).

condylectomy is recommended to remove the entire condylar head because this procedure would not limit function and stability.[1,7] After either kind of condylectomy is performed, orthognathic surgery and orthodontic treatment are necessary to correct the remaining skeletal discrepancy and occlusal problems.

There are two treatment options for unilateral condylar hyperplasia (UCH) according to patient age. In growing adolescent patients, surgical treatment can be delayed until completion of condyle growth. However, prolonged growth of the condyle can worsen the dentofacial deformity, which can make it difficult to obtain functional occlusion and an esthetic outcome.[1] In adult patients, simultaneous condylectomy and orthognathic surgery[5,8,9] or condylectomy only without orthognathic surgery can be performed.[7,10–13] In adult patients with a mild to moderate maxillary transverse occlusal plane (MXTOP) cant due to UCH, a proportional condylectomy can be performed to remove the active growth potential of the affected condyle and resolve the vertical height difference in the condyle between the affected and non-affected sides.[7,12,13] It can reduce the possibility of secondary orthognathic surgery compared with high condylectomy.[7,12]

Although there are some case reports about treatment of UCH with high condylectomy and without orthognathic surgery,[10,11] there has been no case report demonstrating treatment of UCH with proportional condylectomy and fixed orthodontic treatment. Therefore, the purpose of this case report was to present a case of UCH and posterior open bite, which was treated with proportional condylectomy and fixed orthodontic treatment.

CASE REPORT

Patient

A 29-year-old female patient with UCH visited the Department of Orthodontics, Seoul National University Dental Hospital (SNUDH), Seoul, Republic of Korea.

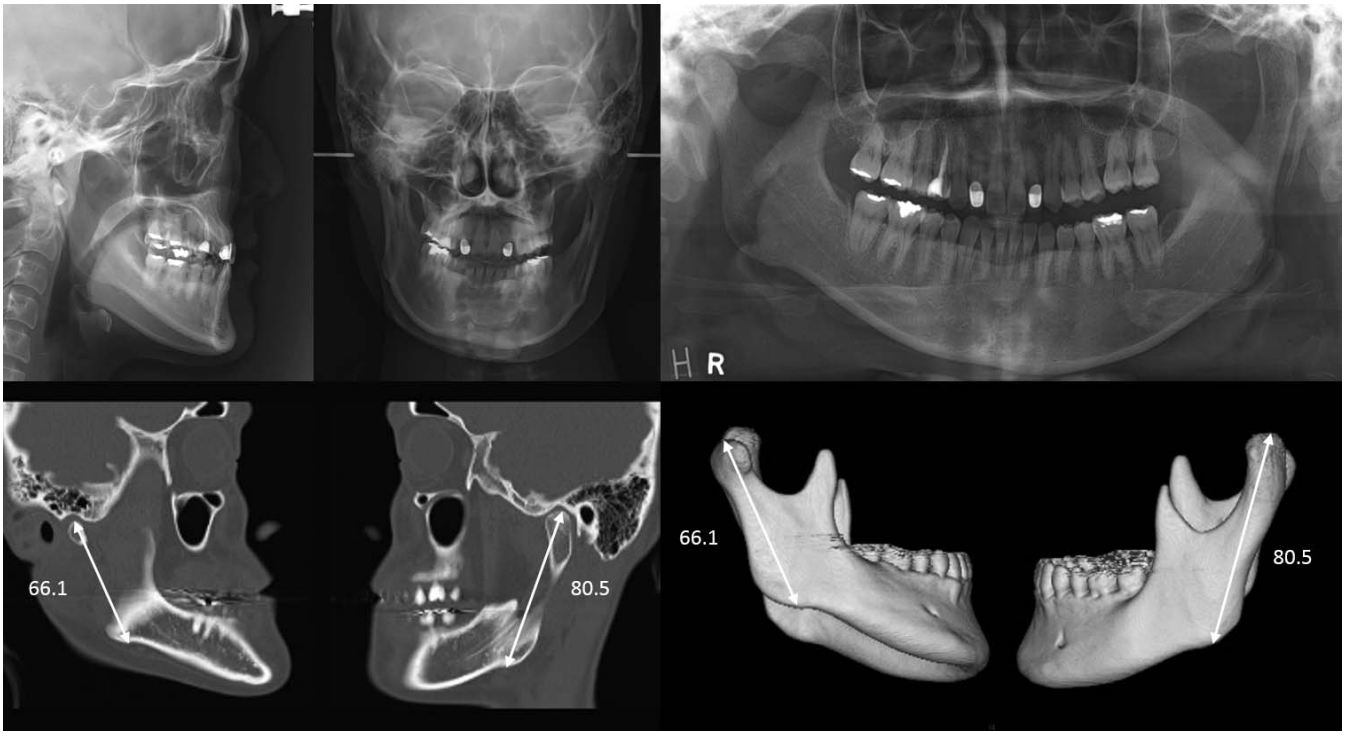

Figure 2. Lateral and posteroanterior cephalograms, panoramic radiograph, and three-dimensional computed tomography taken at the initial visit (age 29 years, 2 months).

Table 1. Cephalometric Measurements

Measurement	Stage 0, Taken at Initial Visit (29 y 2 mo)	Stage 1, Taken 4 months After Condylectomy (29 y 8 mo)	Stage 2, Taken at Debonding (30 y 8 mo)	Stage 3, Taken at 2-year Retention (32 y 8 mo)	Ethnic Mean Value
SNA (°)	78.0	78.0	78.5	78.8	81.1 ± 3.7
SNB (°)	79.5	75.5	76.7	76.1	78.0 ± 3.8
ANB (°)	−1.5	2.4	1.8	2.6	3.5 ± 1.9
A to N perp (mm)	−2.6	−2.7	−2.9	−2.0	0.4 ± 2.3
Pog to N perp (mm)	4.2	−5.9	−4.2	−5.2	−1.8 ± 4.5
FMA (°)					
Right side	18.8	30.0	29.8	30.1	29.6 ± 5.7
Left side	21.7	28.1	26.4	27.6	29.6 ± 5.7
Gonial angle (°)					
Right side	120.9	125.5	125.0	129.5	124.3 ± 5.4
Left side	116.5	122.0	119.3	121.7	124.3 ± 5.4
U1 to SN (°)	96.1	96.1	90.5	92.4	105.3 ± 6.6
IMPA (°)	78.3	78.3	82.9	80.2	91.6 ± 5.2
Interincisal angle (°)	154.7	148.0	150.5	149.6	125.4 ± 9.2
Overbite depth indicator (ODI)	63.3	65.4	65.8	66.2	72.0 ± 5.5
Anteroposterior dysplasia indicator (APDI)	87.7	76.9	79.0	77.4	85.7 ± 4.0
Chin point deviation (mm)	11.5	7.8	3.7	4.0	0
MXTOP[a] cant (°)[b]	3	3	1	2	0
MXTOP[a] cant (mm)[c]	3.5	3.5	1.7	2.3	0
Overbite (mm)	0.5	−0.8	2.4	1.7	1-3
Overjet (mm)	1.7	5.1	2.9	2.9	1-3

[a] The line connecting the medial aspect of the zygomaticofrontal sutures served as the reference line to measure the maxillary transverse occlusal plane (MXTOP) cant.
[b] The angle formed by the line connecting the medial aspect of the zygomaticofrontal sutures and occlusal plane.
[c] The difference of the height of the occlusal plane to the line connecting the medial aspect of the zygomaticofrontal sutures.

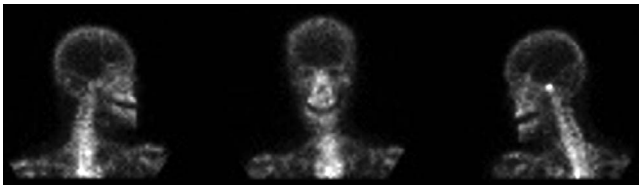

Figure 3. Bone scan with Tc99m methylene diphosphonate (age 29 years, 3 months).

Her chief complaint was facial asymmetry. She had a history of TMJ pain in the left side at the age of 19 years and orthodontic treatment for 5 years until the age of 25 at the local clinic.

This case report was reviewed and approved by the institutional review board at SNUDH (ERI18011). Written consent was received from the patient.

Clinical Findings and Diagnosis (Stage 0)

The patient presented with facial asymmetry, lip cant, posterior open bite (3.5 mm), and Class III canine and molar relationships (3.0 mm) on the left side (Figure 1). Lateral cephalometric analysis showed a skeletal Class III relationship (ANB, –1.5°), retrusive maxilla (SNA, 78.0°; A to N perpendicular (perp), –2.6 mm), protrusive mandible (Pog to N perp, 4.2 mm), and low mandibular plane angle (FMA, 18.8° on the right side and 21.7° on the left side) (Figure 2; Table 1). Both the maxillary and mandibular central incisors were lingually inclined (U1 to SN, 96.1°; IMPA, 78.3°; Figure 2; Table 1). Posteroanterior cephalometric analysis showed an 11.5 mm chin point deviation (CPD) to the right side, and 3° and 3.5 mm MXTOP cant (Figure 2; Table 1).

Panoramic radiograph and three-dimensional computed tomography (3D-CT) images revealed 14.4 mm elongation of the left condyle compared with the right condyle (Figure 2). In the bone scan with Tc99m methylene diphosphonate, the focal area of increased uptake was observed at the left condyle, which suggested a possibility of active growth potential (Figure 3).

In this patient, the posterior open bite on the left side at the initial visit (Figures 1 and 2) seemed to have occurred through rapid growth of the left condyle and minimal compensatory downward growth of the maxilla. Therefore, the patient was diagnosed with an Angle Class III malocclusion, facial asymmetry, and posterior open bite due to UCH (Wolford Type 1B) of the left side.

Treatment Objectives

The treatment objectives were (1) to remove the active growth potential of the left condyle and close the posterior open bite on the left side, (2) to correct the CPD and MXTOP cant, and (3) to establish functional occlusion and improve facial esthetics.

Treatment Planning

Stage 1. Management of the UCH. To simultaneously remove the active growth potential in the left condyle and correct the CPD, proportional condylectomy of the left condyle was planned. The amount of vertical difference between right and left ramus heights was 14.4 mm, which was measured with 3D-CT (Figure 2).

Stage 2. Correction of the remaining skeletal discrepancy and occlusal problems. To correct the MXTOP cant and Class III relationship, two treatment options were suggested to the patient:

The first option was fixed orthodontic treatment and miniscrew therapy to intrude the left maxillary molars to correct the MXTOP cant and establish Class I occlusion. After orthodontic treatment, mandibuloplasty and genioplasty were suggested to improve facial esthetics.

The second option was presurgical orthodontic treatment, mandibular orthognathic surgery, and postsurgical orthodontic treatment to correct the remaining

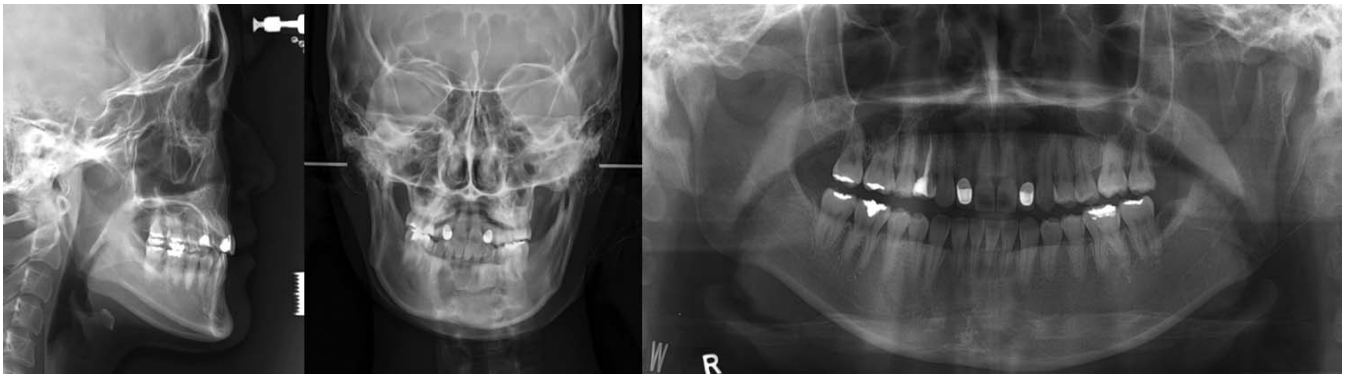

Figure 4. Lateral and posteroanterior cephalograms and panoramic radiograph taken 1 day after proportional condylectomy (age 29 years, 4 months).

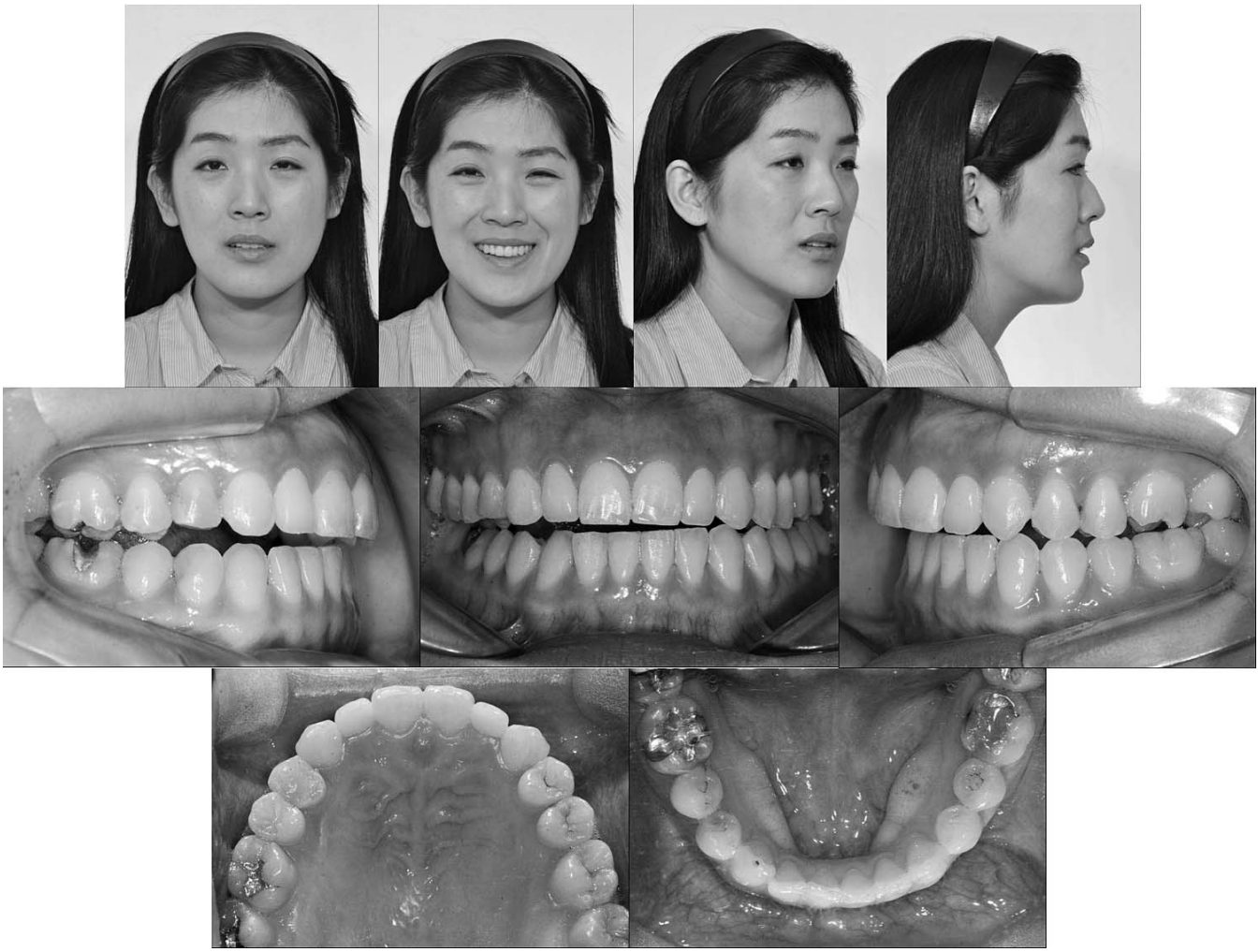

Figure 5. Facial and intraoral photographs taken 4 months after proportional condylectomy (age 29 years, 8 months).

skeletal discrepancy and occlusal problems. If necessary, two-jaw orthognathic surgery could be proposed after presurgical orthodontic treatment.

The patient chose the first option because of the surgical risk in the second option.

Treatment Progress

Management of the UCH. After preauricular incision, proportional condylectomy with 14-mm resection of the left condylar head, including the lateral and medial

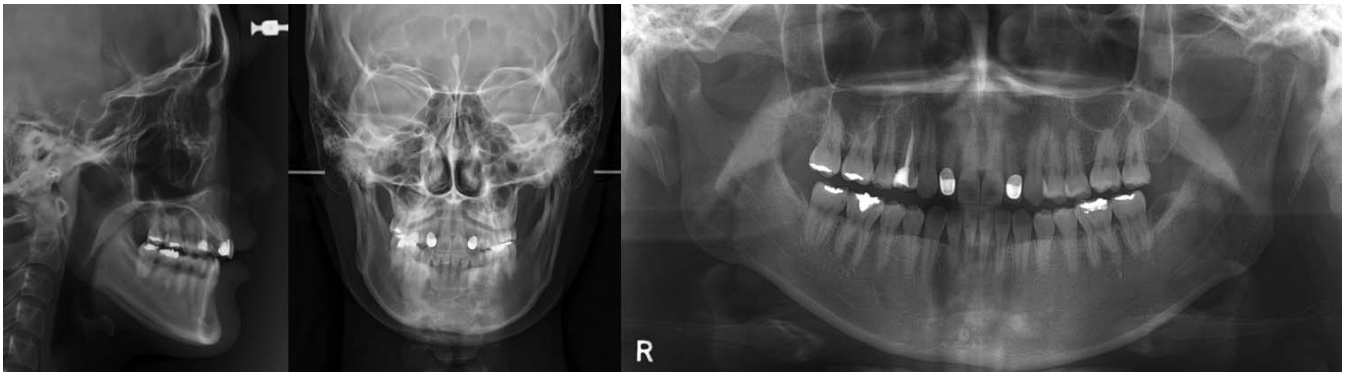

Figure 6. Lateral and posteroanterior cephalograms and panoramic radiograph taken 4 months after proportional condylectomy (age 29 years, 8 months).

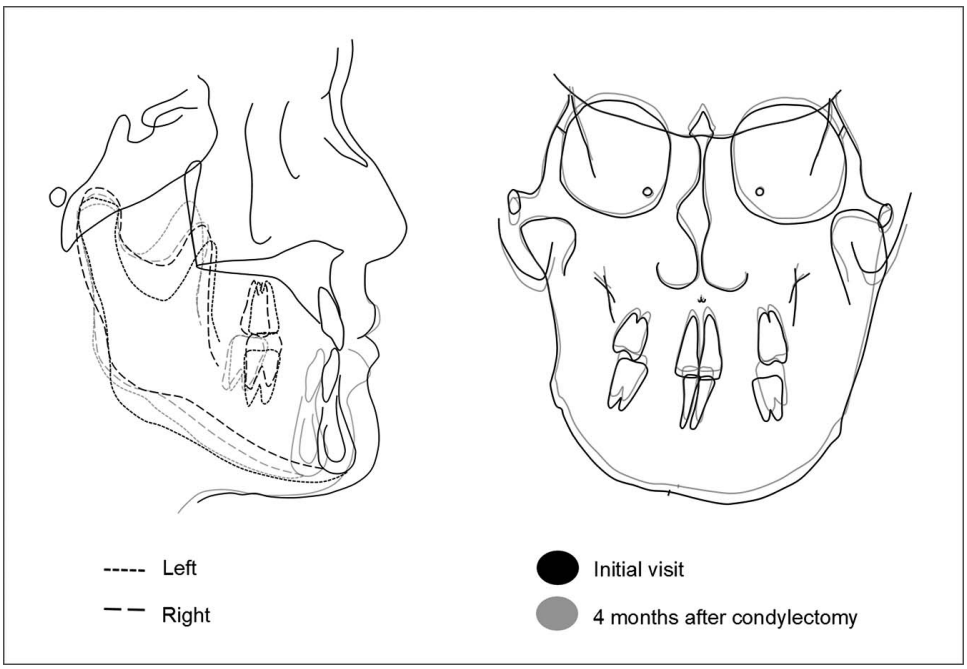

Figure 7. Superimposition of the lateral and posteroanterior cephalogram tracings between the initial visit and 4 months after proportional condylectomy (Right, long dashed line; Left, dashed line).

poles, was performed (Figure 4). The remaining condylar head was rounded with a low speed bur. In histopathological examination, there was no pathologic finding in the resected condylar head.

Proportional condylectomy produced significant improvement of CPD (from 11.5 mm to 7.8 mm), and closure of the posterior open bite on the left side (Figures 5 through 7; Tables 1 through 3). In addition,

Table 2. Change in Cephalometric Measurements

Measurement	Stage 0 to 1, From Initial Visit to 4 mo After Condylectomy	Stage 1 to 2, From 4 mo After Condylectomy to Debonding	Stage 0-2, From Initial Visit to Debonding	Stage 0 to 3, From Debonding to 2-y Retention
ΔSNA (°)	0.0	0.5	0.5	0.3
ΔSNB (°)	−4.0	1.2	−2.8	−0.6
ΔANB (°)	3.9	−0.6	3.3	0.8
ΔA to N perp (mm)	−0.1	−0.2	−0.3	0.9
ΔPog to N perp (mm)	−10.1	1.7	−8.4	−1.0
ΔFMA (°)				
Right side	11.2	−0.2	11.0	0.3
Left side	6.4	−1.7	4.7	1.2
ΔGonial angle (°)				
Right side	4.6	−0.5	4.1	4.5
Left side	5.5	−2.7	2.8	2.4
ΔU1 to SN (°)	0.0	−5.6	−5.6	1.9
ΔIMPA (°)	0.0	4.6	4.6	−2.7
ΔInterincisal angle (°)	−6.7	2.5	−4.2	−0.9
ΔODI	2.1	0.4	2.5	0.4
ΔAPDI	−10.8	2.1	−8.7	−1.6
ΔChin point deviation (mm)	−3.7	−4.1	−7.8	0.3
ΔMXTOP cant (°) [a]	0	−2.0	−2.0	1.0
ΔMXTOP cant (mm) [b]	0	−1.8	−1.8	0.6
ΔOverbite (mm)	−1.3	3.2	1.9	−0.7
ΔOverjet (mm)	3.4	−2.3	1.2	0.0

[a] The angle formed by the line connecting the medial aspect of the zygomaticofrontal sutures and occlusal plane.
[b] Difference of the height of the occlusal plane to the line connecting the medial aspect of the zygomaticofrontal sutures.

Table 3. Treatment Progress

Treatment Methods	Age	Treatment Duration	Accumulated Treatment Duration
Stage 0			
Initial visit	29 y 2 mo	-	-
Stage 1			
Proportional condylectomy	29 y 4 mo	5 mo	5 mo
Stage 2			
Bonding of the maxillary arch	29 y 9 mo	6 mo	11 mo
Bonding of the mandibular arch	29 y 11 mo		
Intrusion of left maxillary molars and total retraction of the maxillary arch with miniscrews and elastomeric traction	30 y 3 mo	3 mo	1 y 2 mo
Removal of miniscrews	30 y 6 mo	2 mo	1 y 4 mo
Debonding	30 y 8 mo		
Stage 3			
2-year retention	32 y 8 mo	-	-

Figure 8. Facial and intraoral photographs taken during fixed orthodontic treatment with 0.018 × 0.025 copper nickel titanium archwires (age 30 years, 2 months).

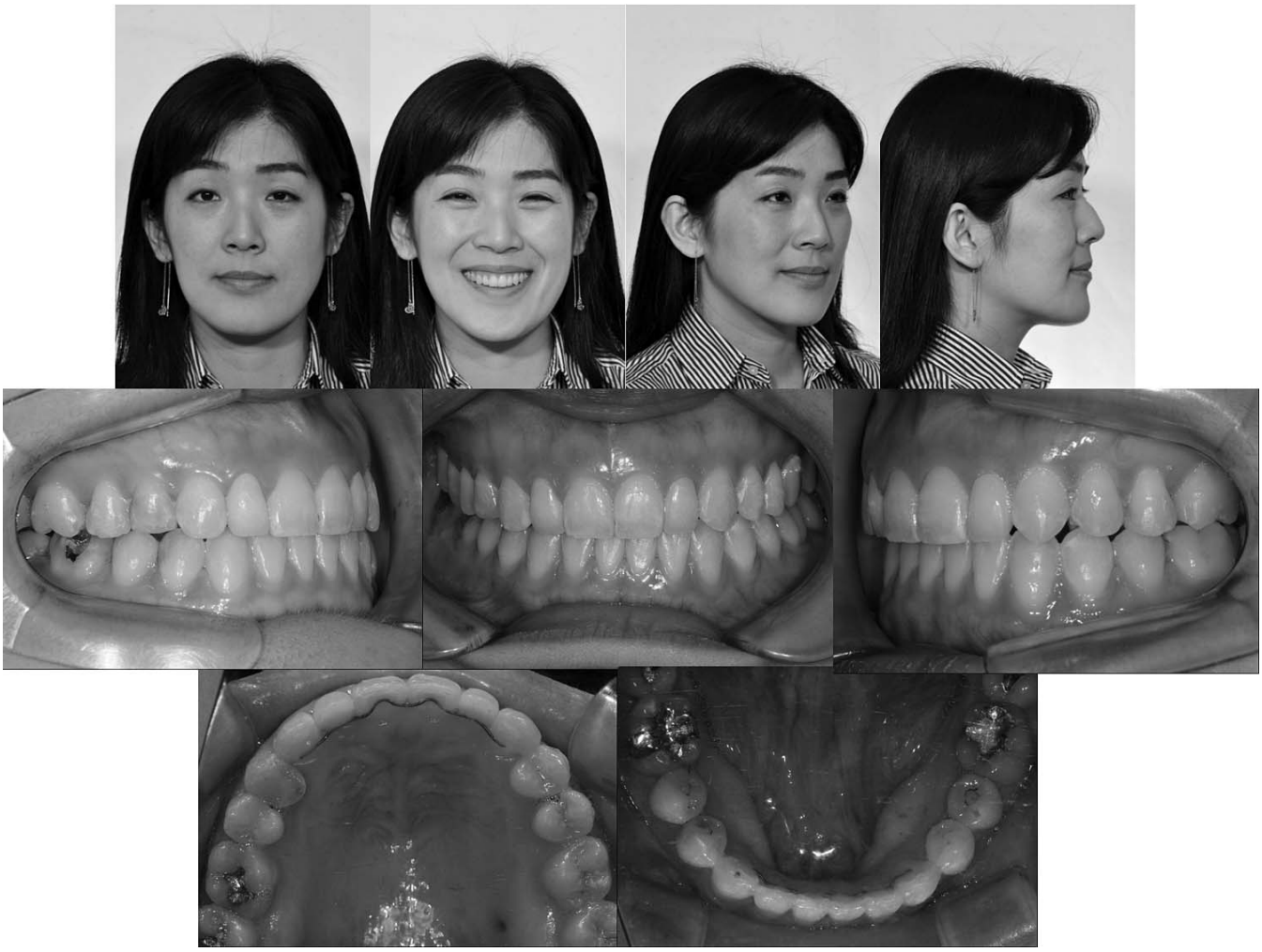

Figure 9. Facial and intraoral photographs taken at debonding (age 30 years, 8 months).

clockwise rotation of the mandible was achieved (FMA, from 18.8° to 30.0° on the right side and from 21.7° to 28.1° on the left side; Figures 5 through 7; Tables 1 through 3). Therefore, it produced Class II canine and molar relationships on the right and left sides, unilateral posterior open bite on the right side, and anterior open bite (Figures 5 through 7). There were no significant side effects, including facial nerve damage. After 4 months, physiologic bone remodeling of the left condyle was observed (Figures 6 and 7).

Correction of the remaining skeletal discrepancy and occlusal problems. After 5 months, fixed orthodontic

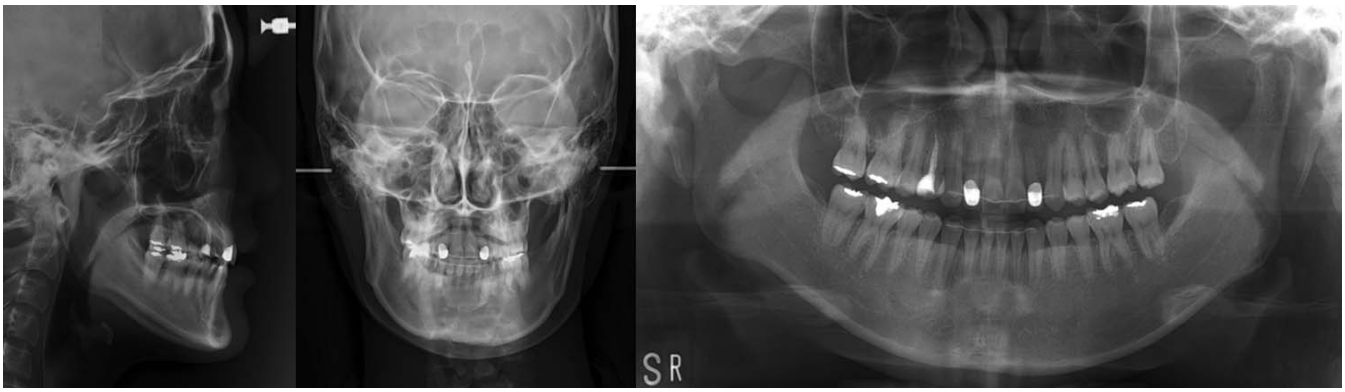

Figure 10. Lateral and posteroanterior cephalograms and panoramic radiograph taken at debonding (age 30 years, 8 months).

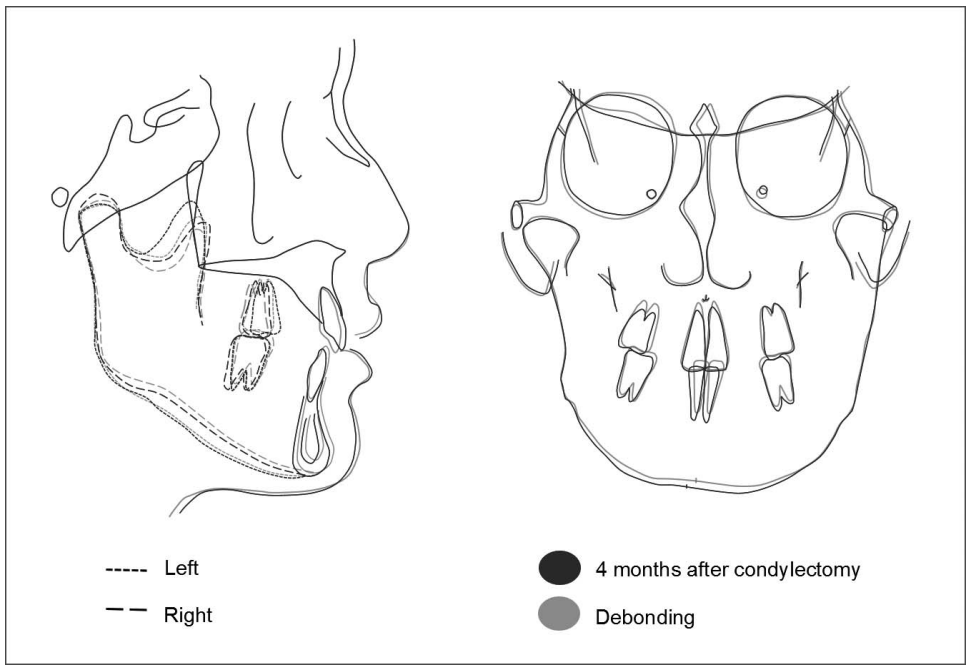

Figure 11. Superimposition of the lateral and posteroanterior cephalogram tracings between 4 months after proportional condylectomy and debonding (Right, long dashed line; Left, dashed line).

treatment was initiated. With the combination of heavy rectangular stainless steel continuous archwire, miniscrews installed at the buccal and palatal gingiva, and elastomeric chain traction, intrusion of the left maxillary molar (1.8 mm) and total retraction of the maxillary arch were performed (Figure 8; Tables 1 through 3). As a result, the MXTOP cant was almost fully corrected (from 3° to 1° and from 3.5 mm to 1.7 mm) and the CPD on the right side was reduced (from 7.8 mm to 3.7 mm) (Figures 9 through 11; Tables 1 through 3). In addition, slight counterclockwise rotation of the mandible on the left side was produced (FMA,

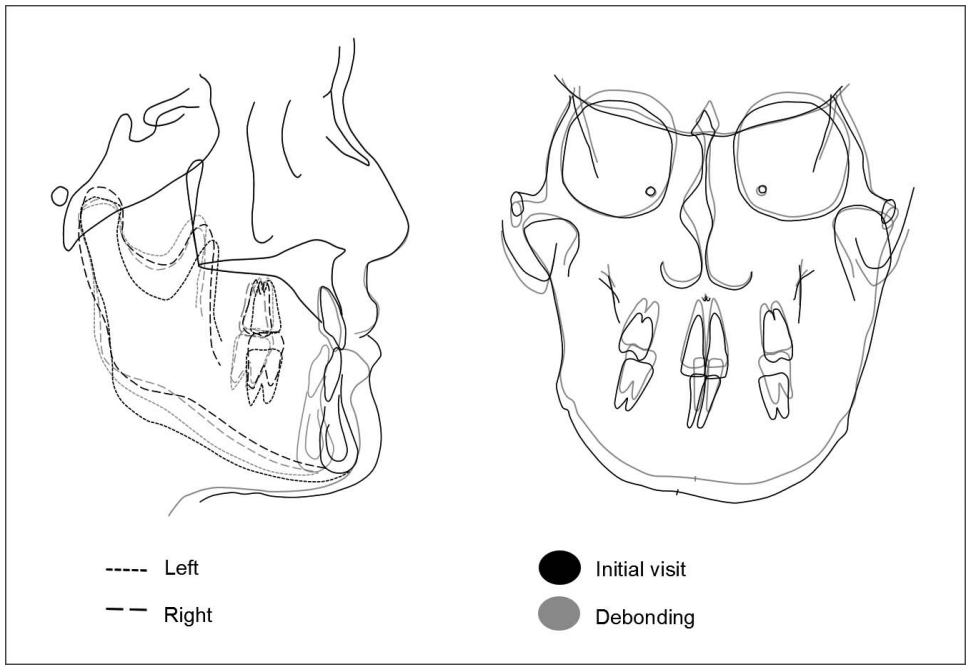

Figure 12. Superimposition of the lateral and posteroanterior cephalogram tracings between the initial visit and debonding (Right, long dashed line; Left, dashed line).

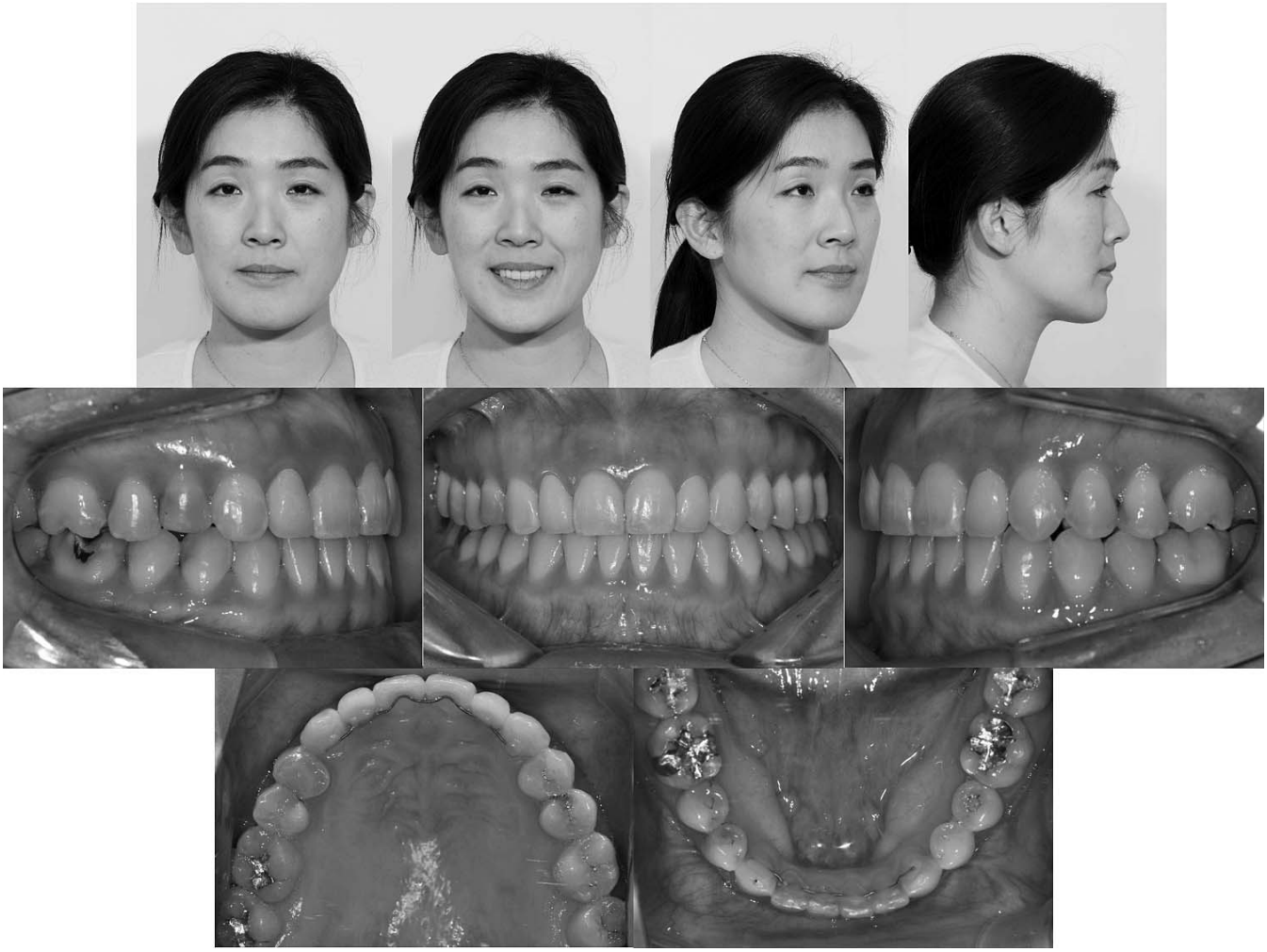

Figure 13. Facial and intraoral photographs taken after 2 years of retention (age 32 years, 8 months).

from 28.1° to 26.4°) and the unilateral posterior open bite on the right side and anterior open bite were resolved (Figures 9 through 11; Tables 1 through 3). Fixed orthodontic treatment was continued for 11 months.

After debonding, fixed retainers were bonded on the maxillary and mandibular anterior teeth, and a circumferential retainer was applied to the maxillary arch (Figures 9 and 10).

Treatment Results

After 1 year and 4 months of total treatment, normal overbite/overjet, Class I canine and molar relation-

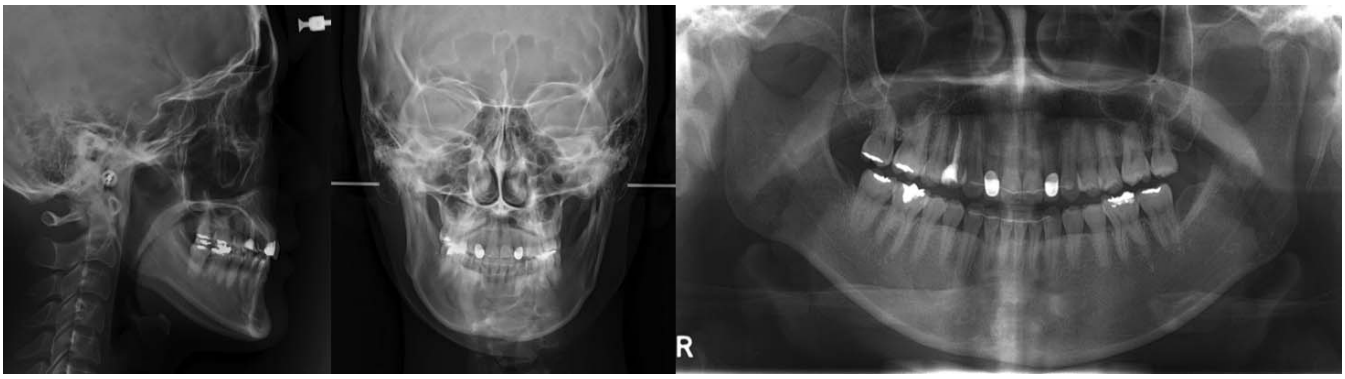

Figure 14. Lateral and posteroanterior cephalograms and panoramic radiograph taken after 2 years of retention (age 32 years, 8 months).

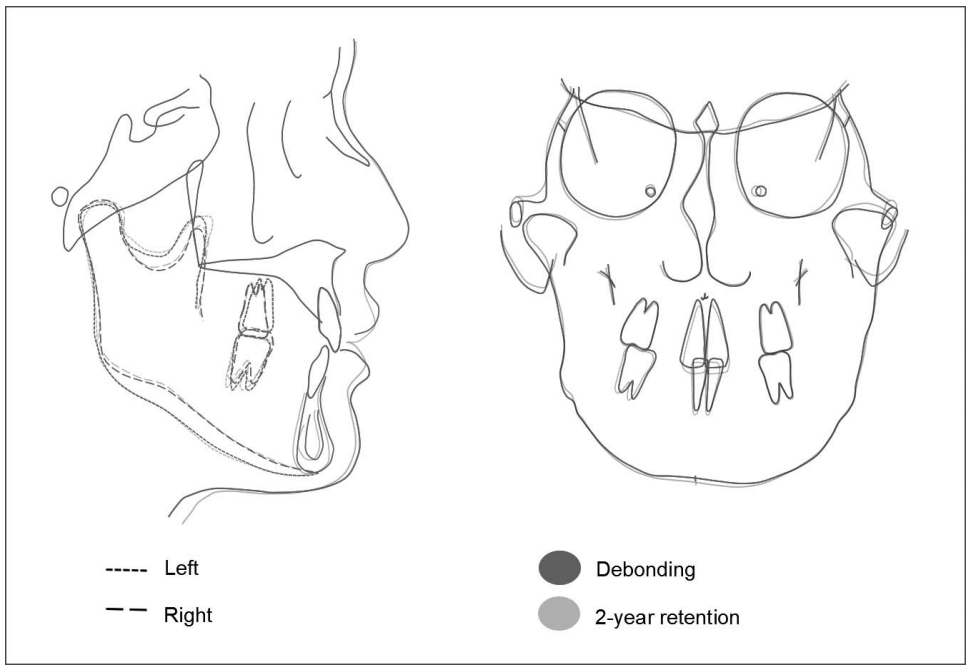

Figure 15. Superimposition of the lateral and posteroanterior cephalogram tracings between debonding and 2 years of retention (Right, long dashed line; Left, dashed line).

ships, and stable occlusion were obtained (Figures 9 through 12; Tables 1 through 3). In addition, the CPD and MXTOP cant were significantly improved (Figures 9 through 12; Tables 1 through 3). Although mandibuloplasty and genioplasty were recommended for correction of asymmetry in the lower border of the mandible and chin prominence, the patient refused surgery.

The panoramic radiograph showed physiologic bone remodeling of the condylar head on the affected side, resulting in smooth and intact cortical lining of the left condyle (Figure 10).

Lateral cephalometric analysis showed a skeletal Class I relationship (ANB, 1.8°), retrusive maxilla and mandible (SNA, 78.5°; SNB, 76.7°; A to N perp, –2.9 mm; Pog to N perp, –4.2 mm), normal mandibular plane angle (FMA, 29.8° in the right side and 26.4° in the left side), and normal gonial angle (125.0° in the right side and 119.3° in the left side) (Table 1). Although the maxillary and mandibular central incisors were lingually inclined (U1 to SN, 90.5°; IMPA, 82.9°), normal overjet and overbite were obtained (overbite, 2.4 mm; overjet, 2.9 mm) (Table 1).

Retention

After a 2-year retention period, the treatment result was well maintained in terms of Class I canine and molar relationships, normal overbite/overjet, and stable occlusion. Improvement of CPD (from 3.7 mm to 4.0 mm) and MXTOP cant (from 1° to 2° and from 1.7 mm to 2.3 mm) were also well maintained (Figures 13 through 15; Tables 1 through 3).

During the 2-year retention period, the maxilla positioned slightly forward (ΔSNA, 0.3°; ΔA to N perp, 0.9 mm; Figure 15; Table 2), while the mandible positioned slightly backward (ΔSNB, –0.6°; ΔPog to N perp, –1.0 mm; Figure 15; Table 2). Therefore, the ANB angle was slightly increased (ΔANB, 0.8°; Figure 15; Table 2), as was the mandibular plane angle (ΔFMA, 0.3° in the right side and 1.2° in the left side). There was slight labioversion of the maxillary incisors (ΔU1 to SN, 1.9°; Figure 15; Table 2) and linguoversion of the mandibular incisors (ΔIMPA, –2.7°; Figure 15; Table 2), which might have occurred because of occlusal contact and bite force between the maxillary and mandibular incisors. However, changes in overbite and overjet were minimal (ΔOverbite, –0.7 mm; ΔOverjet, 0.0 mm; Figure 15; Table 2).

After 5 years in retention, the treatment result remained stable. However, the patient could not undergo radiography due to pregnancy (Figure 16).

DISCUSSION

In this patient, UCH and posterior open bite were well treated with proportional condylectomy and fixed orthodontic treatment (Figure 17) and the treatment outcome was well-maintained after 5 years of retention (Figure 18). There are three reasons for achieving good treatment results without orthognathic surgery in this patient. First, the active growth potential of the

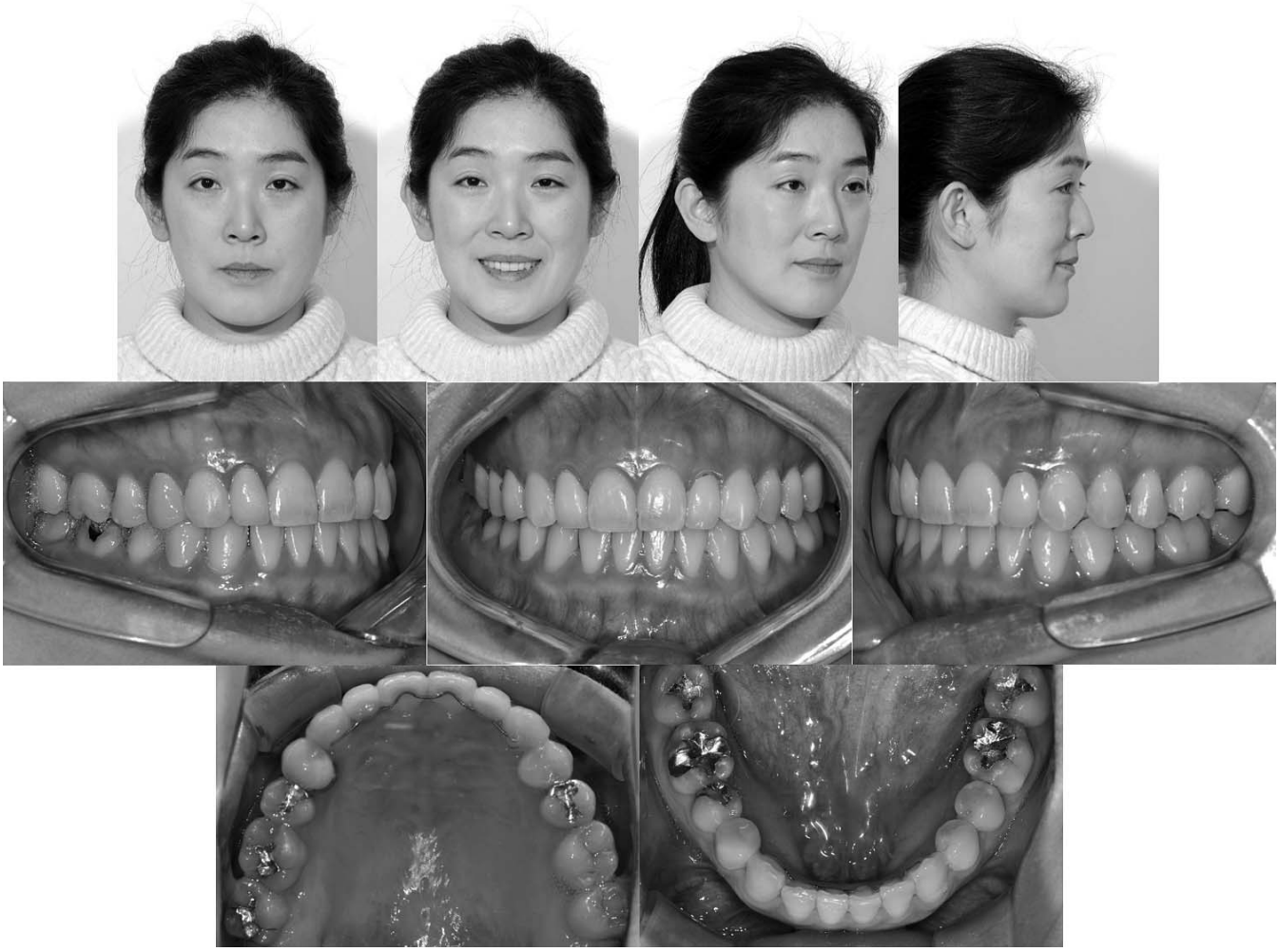

Figure 16. Facial and intraoral photographs taken at 5 years of retention (age 35 years, 10 months).

affected condyle in patients with UCH ceases with removal of the most active part of the condylar growth.[5] Therefore, proportional condylectomy could stop the condylar growth of the affected side. Second, the patient had a relatively mild MXTOP cant (3° and 3.5 mm difference between the right and left sides) and a mild to moderate anteroposterior discrepancy (3 mm Class III relationship on the left side). Third, the patient exhibited a moderate posterior open bite on the left side (3.5 mm) and little dental compensation. Therefore, after proportional condylectomy, the remaining skeletal discrepancy and occlusal problems could be corrected with fixed orthodontic treatment.

After proportional condylectomy and during fixed orthodontic treatment, the patient did not complain of TMJ discomfort. This finding was in accordance with Mouallem et al.,[13] who reported that TMJ functions were considered normal in 93% of patients after proportional condylectomy.

For a guideline for treatment of UCH (Wolford Type 1B), a flow chart is suggested in Figure 19. First, if a patient with UCH is still growing, surgery should be

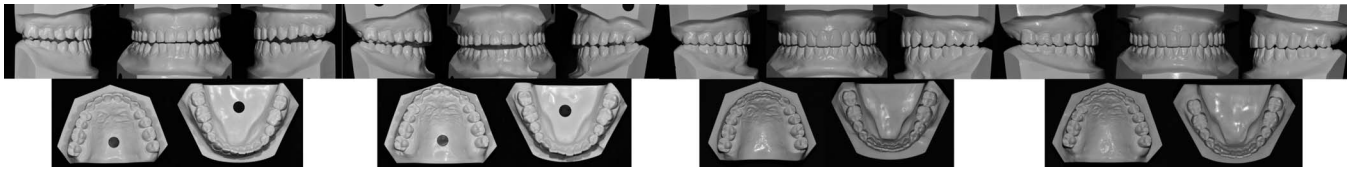

Figure 17. A series of dental casts. Initial visit (age 29 years, 2 months, far left). Four months after proportional condylectomy (age 29 years, 8 months, second from the left). Debonding (age 30 years, 8 months, the second from the right). Two-year retention (age 32 years, 8 months, far right).

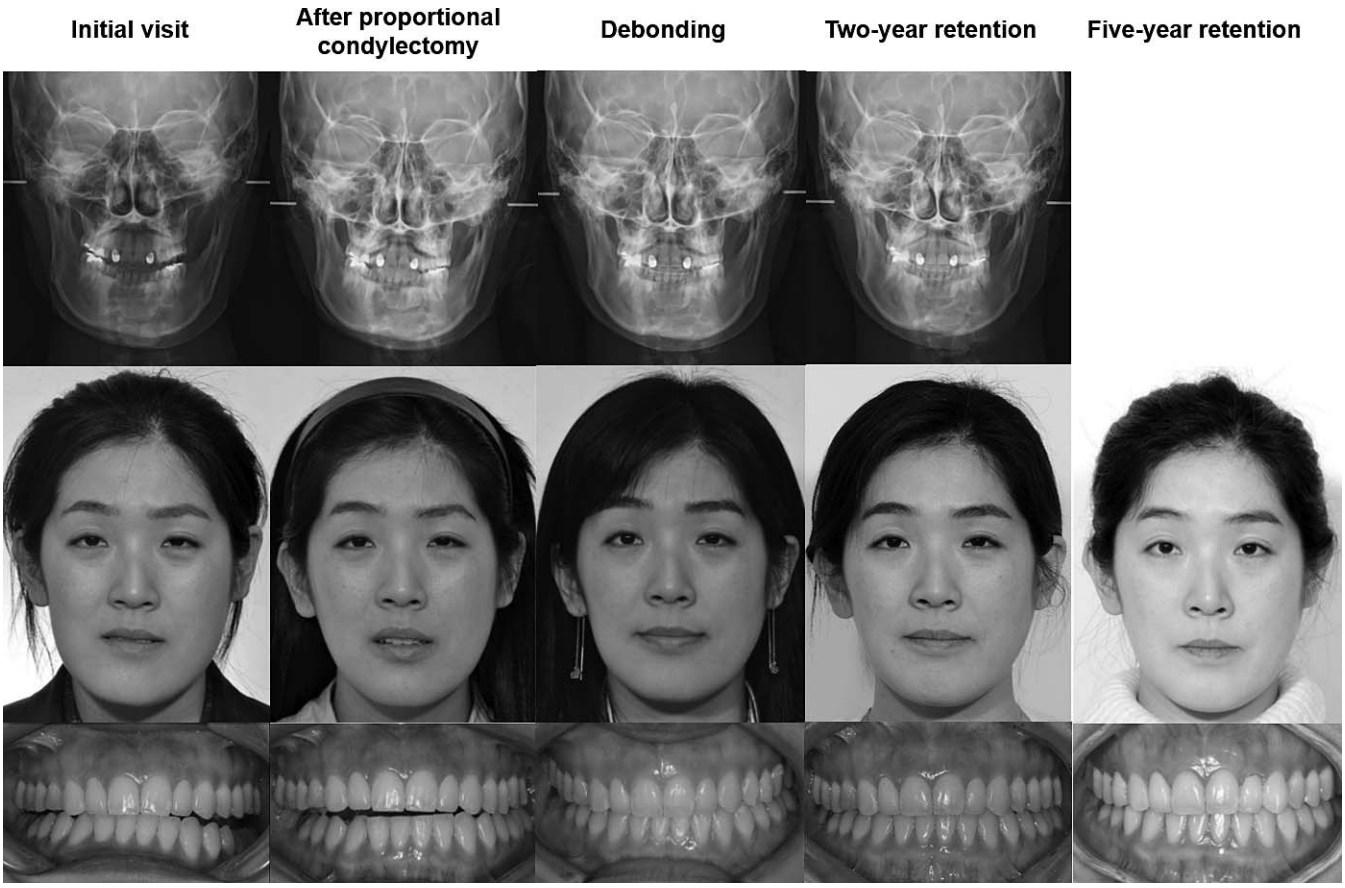

Figure 18. Series of posteroanterior cephalograms, facial and intraoral frontal photographs.

delayed until completion of condylar growth. If condylectomy is performed on the affected side before cessation of condyle growth, there is risk of a mandibular shift to the affected side because the condyle on the unaffected side will continue normal growth.[1]

Second, if a patient with UCH is an adult, a bone scan should be performed to determine the focal area of increased uptake in the condyle, which indicates active growth potential. After confirmation of no increase in the uptake of the radioisotope in the condyle of the affected side, the patient can be treated with conventional orthognathic surgery. When increased uptake of the radioisotope in the condyle is observed, condylectomy should be performed to arrest the aberrant condylar growth. Proportional condylectomy can remove the active growth potential of the condyle and correct the difference in the vertical height of the condyle between the affected and nonaffected sides.

Third, after proportional condylectomy, the degree of remaining MXTOP cant and skeletal discrepancy are the main factors in determining whether orthodontic treatment and/or orthognathic surgery are required. A 3- to 4-mm MXTOP cant can be corrected through intrusion of the maxillary molars with miniscrews or miniplate therapy,[14–17] while a MXTOP cant greater than 4 mm might need orthognathic surgery.

Fourth, one-jaw or two-jaw surgery can be determined according to the remaining skeletal discrepancy and degree of dental compensation. If these values are low, one-jaw mandibular surgery could be recommended. When the values are high, two-jaw surgery would be a better option.

Fifth, when a patient has relatively good arch width coordination, less crowding, and stable occlusal stops, preoperative orthodontic treatment would not be necessary.

Surgical and orthodontic treatment outcomes would be more predictable with the simulation of three-dimensional virtual computer-aided surgery and orthodontic treatment.[8]

CONCLUSIONS

- For the correction of UCH, it is important to determine the amount of condylar head resection and accurately simulate the correction of CPD and MXTOP cant through intrusion of the maxillary molars.

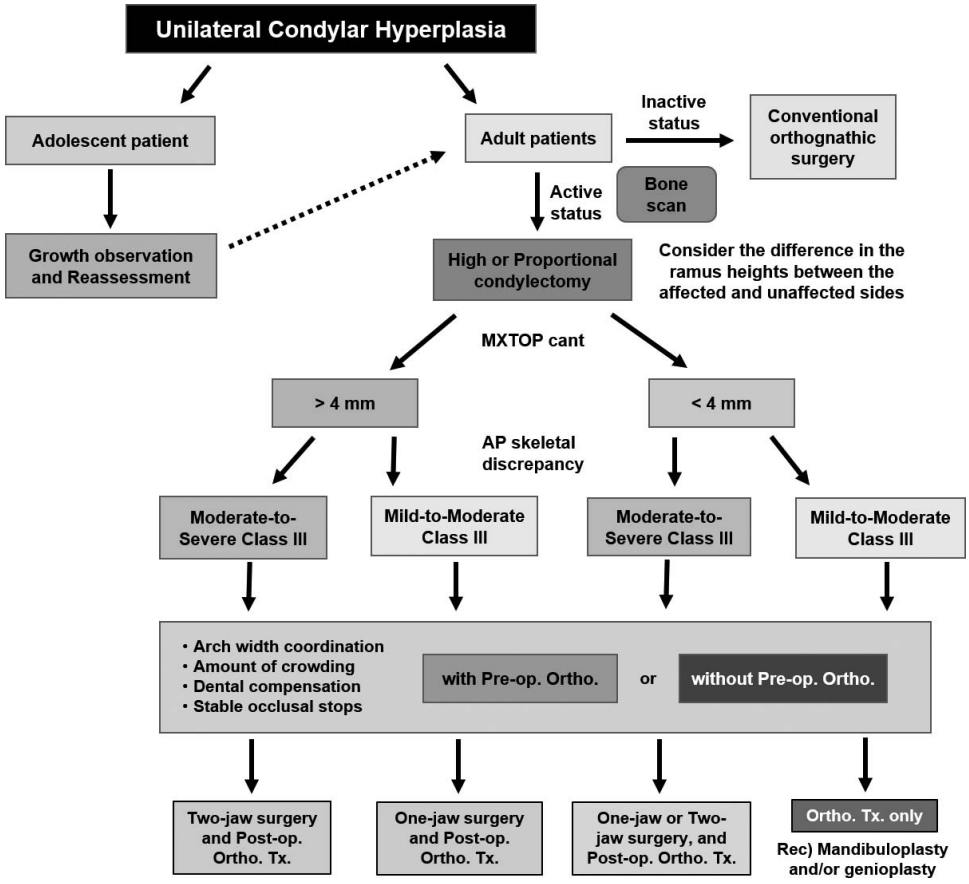

Figure 19. Flow chart of treatment for unilateral condylar hyperplasia (Wolford Type 1B) as a guideline.

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