Case Report

Nonsurgical orthodontic treatment of a hypodivergent adult patient with bilateral posterior scissors bite and excessive overjet

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ABSTRACT

This report illustrates successful nonsurgical orthodontic treatment of a hypodivergent adult patient with bilateral posterior scissors bite (Brodie bite) and excessive overjet. A 26-year-old woman primarily reported maxillary incisor protrusion. She was diagnosed with Class II division 1 malocclusion with skeletal Class I, short face, low mandibular plane angle and bilateral posterior scissors bite. A lingual arch with anterior bite block and posterior miniscrews with preadjusted edgewise appliances were used to improve the bilateral scissors bite. After achieving molar occlusion, the maxillary first premolars were extracted, and six miniscrews were used to improve the anterior-posterior and vertical discrepancies. After active treatment for 56 months, the convex facial profile with excessively protruded lips was improved and good interdigitation with ideal incisor relationship was achieved. Additionally, the irregular movements of the incisal path and the bilateral condyles during lateral excursion were improved. At 13 months of retention, a satisfactory facial profile, occlusion, and jaw movements were maintained. The treatment results suggest that miniscrews and fixed bite blocks were effective and efficient to facilitate correction of the bilateral scissors bite, excessive overjet, and vertical relationship correction in this nonsurgical orthodontic treatment. (*Angle Orthod.* 2019;89:333–349)

KEY WORDS: Bilateral scissors bite; Brodie bite; Non-growing patient; Temporary anchorage devices

INTRODUCTION

Bilateral scissors bite is also known as Brodie bite syndrome or telescopic bite due to the combination of excessive maxillary width and mandibular deficiency.[1–3] Though some syndromes, such as the hypoglossia-hypodactyly syndrome,[4,5] have the characteristic of bilateral scissors bite due to shortening or deformity of the mandible, the mandibular alveolar process is generally narrow, while the width of the mandibular base is usually normal in nonsyndromic patients.[6] In addition to this transverse problem, vertical problems also exist, including deep bite, extrusion of the posterior teeth, and reduced occlusal height in some cases.[1,2,6]

Previous reports have described orthodontic treatment with growth modification in young patients with bilateral scissors bite.[2,3] A maxillary removable bite-plate and edgewise appliance with intermaxillary cross-elastic were used to expand the lower arch width and increase the lower facial height in a growing patient.[3] In another instance, the use of masticatory muscle exercises and high-pull headgear was reported in a young adult patient, as late mandibular growth was slight compared with a growing patient.[6] In contrast, orthognathic surgery treatment to correct skeletal disharmonies such as excessive maxillary width and vertical excess is generally recommended for non-growing adult patients with Brodie bite because late mandibular growth is not seen in adult cases.[1,7]

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Figure 1. Initial facial and intraoral photographs.

Therefore, there have been no reports regarding the nonsurgical orthodontic treatment of bilateral scissors bite in nongrowing adult patients.

This report describes orthodontic treatment of a hypodivergent adult with bilateral scissors bite, Angle Class II, division 1 malocclusion, and excessive overjet. Stomatognathic functional changes induced by the nonsurgical treatment and the stability at 13 months' retention is also reported.

CASE REPORT

Diagnosis and Etiology

A woman 26 years and 1 month of age had a chief complaint of maxillary incisor protrusion. Facial photographs showed a convex profile, excessively protruding and incompetent lips, short lower facial height, and circumoral muscle strain on lip closure (Figure 1). When smiling, she showed excessive gingival display on her right side due to the asymmetric maxillary vertical excess. She had excessive overjet (12.0 mm) and a full unit Angle Class II molar relationship bilaterally (Figure 2). Despite her normal overbite (2.5 mm), severe curve of Spee and palatal trauma at the upper anterior segment were observed and hypersensitivity at the lingual surface of the upper incisors was noted. The narrow lower arch telescoped inside the excessively broad upper arch and there was extrusion of the posterior segments except the upper right first molar. A bilateral scissors bite at the molars and

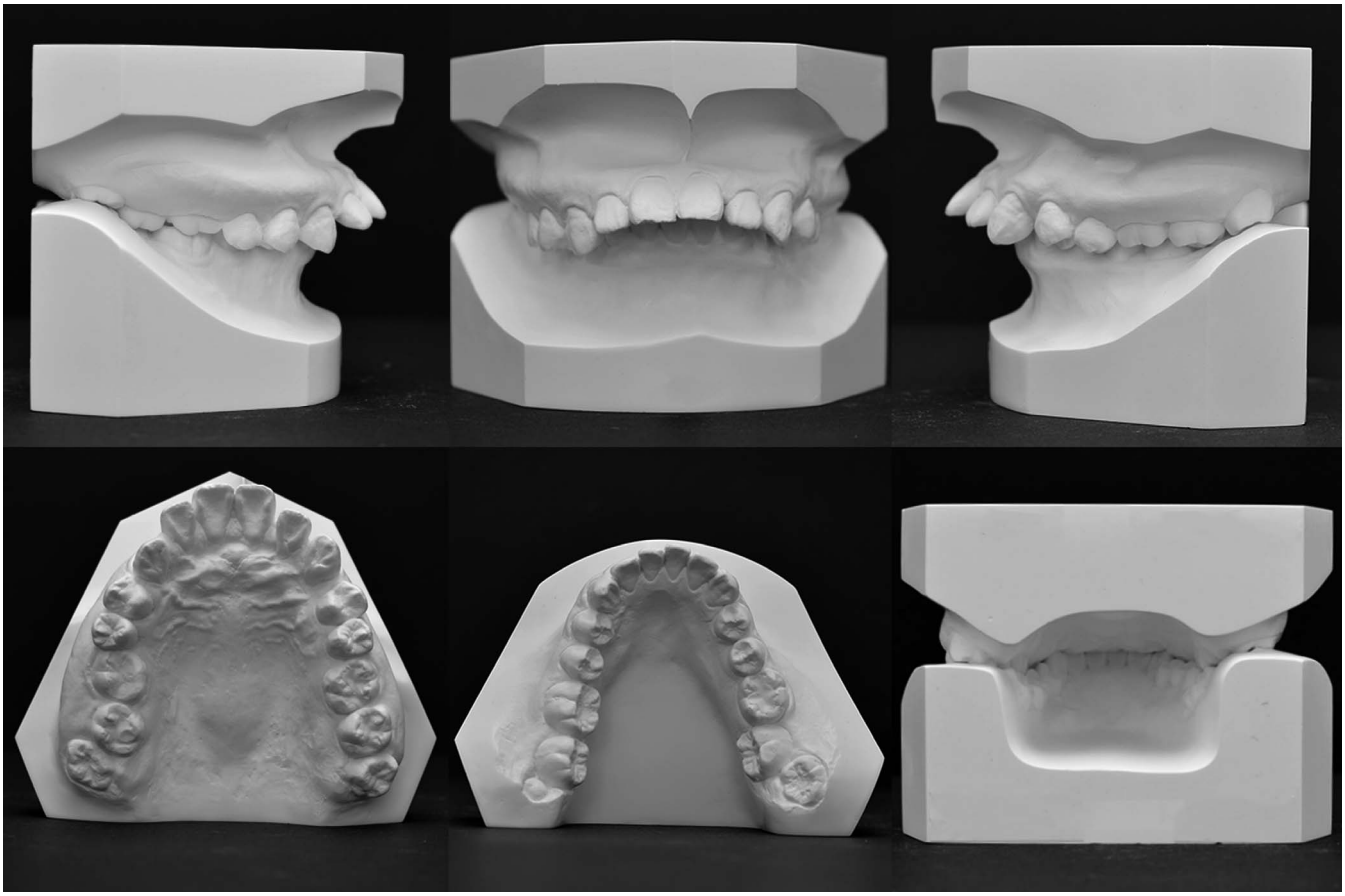

Figure 2. Initial dental casts.

premolars was observed. The centric relation (CR) was deviated by 2.5 mm from the centric occlusion (CO) because of interference at the upper right canine.

The panoramic radiograph revealed substantial loss of alveolar bone in the maxillary anterior and an impacted upper left third molar (Figure 3). Cephalometric analysis (Table 1) showed a skeletal Class I relationship with severe low mandibular plane angle compared with the Japanese norm.[8] Facial height was short, especially the lower facial height. The maxillary incisors were remarkably labially inclined and intruded. The mandibular incisors were also labially inclined. Accordingly, the inter-incisor angle was significantly reduced.

An optoelectric jaw-tracking system was used to record the jaw movements during voluntary lateral excursions and maximum opening and closing. Irregular movements of the incisal path and both condyles on the nonworking side were observed during lateral excursive jaw movements because of the bilateral scissors bite (Figure 4). The patient was diagnosed with Class II division 1 malocclusion with skeletal Class I, short face, low mandibular plane angle, and bilateral posterior scissors bite (Brodie bite).

Treatment Objectives

Treatment objectives were to improve her convex facial profile with protruded lips esthetically and short lower facial height with excessive gingival display when smiling, to correct the bilateral posterior scissors bite with arch width discrepancy and excessive overjet, to flatten the curve of Spee, and to achieve full unit Class II molar relationships and ideal overjet and overbite.

Treatment Alternatives

Elevation of the occlusal height and uprighting of the premolars and molars in both arches were needed to improve the posterior telescopic occlusion and short lower facial height. The excessive overjet due to upper incisor proclination required correction by upper anterior retraction. Therefore, an orthognathic surgical approach with three-segment Le Fort I osteotomy and a bilateral sagittal split osteotomy (BSSO) was planned to accomplish all treatment objectives. On the other hand, if the improvement of the vertical facial problem was compromised, an alternative treatment was planned to correct the bilateral posterior scissors bite by bite opening and using posterior miniscrews to

Figure 3. Initial panoramic and cephalometric radiographs.

upright the posterior teeth. After uprighting of the posterior teeth, intrusion of the posterior teeth was planned to improve unintended mandibular clockwise rotation following bite opening. Miniscrews were needed to maintain the molar relationship and intrude both anterior segments. The patient strongly refused orthognathic surgery and selected the camouflage treatment plan.

Treatment Progress

After extraction of the third molars, a lingual arch with an anterior bite block was attached to the maxilla to increase the occlusal height. Miniscrews (Absoanchor; Dentos, Daegu, South Korea) were inserted between the upper first and second premolar, and between the first and second left molar at the palatal mucosa, and on the buccal in the lower to upright the premolars and

Table 1. Cephalometric measurements[a]

	Mean	SD	Initial 26 y 1 mo	Posttreatment 31 y 7 mo	Postretention 32 y 8 mo
Angular analysis, °					
SNA	80.8	3.6	84.0	85.0	85.0
SNB	77.9	4.5	82.5	81.5	81.5
ANB	2.8	2.4	1.5	3.5	3.5
Mp-SN	37.1	4.6	26.0	23.5	23.5
FMA	30.5	3.6	20.0	17.5	17.5
Gonial angle	122.1	5.3	110.5	110.5	110.5
U1-SN	105.9	8.8	141.5	107.5	108.5
L1-Mp	93.4	6.8	102.5	106.0	107.0
IIA	123.6	10.6	89.5	122.5	120.5
Occ p	16.9	4.4	7.1	12.5	12.5
Linear analysis, mm					
N-Me	125.8	3.7	108.5	105.5	106.0
N/NF	56.0	2.5	53.5	53.5	53.5
Me/NF	68.6	3.7	54.5	52.0	52.5
U1/NF	31.0	2.3	16.0	19.5	19.5
U6/NF	24.6	2.0	17.5	17.5	17.5
L1/Mp	44.2	2.7	44.5	37.5	37.5
L6/Mp	32.9	2.5	31.5	30.0	30.0
Overjet	3.1	1.1	12.0	3.0	3.5
Overbite	3.3	1.9	2.5	2.5	2.5

[a] Mean, average values of Japanese women[8]; SD, standard deviation[8]; S, sella; N, nasion; A, A-point; B, B-point; SN, sella-nasion plane; Mp-SN, angle between mandibular plane and SN; FMA, angle between mandibular plane and Frankfort horizontal (FH) plane; Gonial angle, angle between ramus plane and mandibular plane; U1-SN, angle between axial inclination of maxirally central incisor and SN; L1-Mp, angle between axial inclination of mandibular central incisor and mandibular plane; IIA, angle between upper incisor axis and lower incisor axis; Occ P, angle between SN and occlusal plane; N-Me, distance between nasion and menton; N/NF, perpendicular distance of nasion to nasal floor; Me/NF, perpendicular distance of menton to nasal floor; U6/NF, perpendicular distance of the maxillary first molar to nasal floor; U1/NF, perpendicular distance of the maxillary central incisor to mandibular plane; L6-MP, perpendicular distance of the mandibular first molar to nasal floor; L1-MP, perpendicular distance of the mandibular incisor to mandibular plane.

molars. 0.018-inch slot preadjusted edgewise appliances were bonded to the upper and lower posterior segments with sectional arch wires, and elastic chains were applied from the appliances to the miniscrews. After uprighting of the lower left first molar, a lower lingual arch was attached for uprighting of the lower right second molar (Figure 5A–C).

After improvement of the molar scissors bite, the upper first premolars were extracted. Edgewise appliances were bonded to the upper and lower anterior segments and the upper lingual arch was removed (Figure 5D,E). Miniscrews were inserted between the lower canine and lateral incisors after alignment and intrusion of the lower incisors by ligation was started with 0.016 × 0.022-inch stainless-steel wire. A quad helix and bi helix were attached to improve both arch forms. After 6 months, the miniscrews were reinserted to intrude the lower anterior segment more. The upper arch wire was changed to 0.016 × 0.022-inch stainless steel with closing loops and posterior buccal miniscrews were inserted for absolute anchorage. To improve the deep bite and asymmetric gummy smile, the miniscrews were inserted between the canine and lateral incisors. Occlusal adjustment and interproximal reduction of the lower anterior segment were started during retraction of the upper anterior segment (Figure 6A–D). Because severe root resorption of the upper incisors was observed at 16 months after the start of retraction (6 months after the start of intrusion), the amount of anterior retraction and correction of the midline discrepancy was curtailed after obtaining the patient's informed consent.

Table 2. Dental cast measurements[a]

Variable, mm	Initial	Posttreatment	Postretention
Maxillary inter-canine width	37.0	36.5	37.0
Mandibular inter-canine width	26.0	27.0	26.5
Maxillary inter-first molar width	51.5	48.5	49.0
Mandibular inter-first molar width	39.5	45.5	45.5
Maxillary inter-second molar width	55.5	57.5	57.5
Mandibular inter-second molar width	36.5	52.0	52.5

[a] In the molar width, the distance between the mesiobuccal casps of molar of both sides were determined.

After removing the appliances and miniscrews, removable retainers and bonded retainers were placed in both arches. After 1 month, a stabilization splint was placed at night. The total active treatment period was 56 months.

Treatment Results

The posttreatment records showed that the facial profile, bilateral scissors bite, excessive overjet, and overbite with palatal trauma were significantly improved (Figures 7–9). The circumoral muscle strain, incompetent lip, hypersensitivity, and gummy smile were corrected. Posttreatment models showed transverse expansion of the lower arch width, especially at the second molars (Table 2), good alignment, and an interdigitated dentition with Class II molar relationships. Slight dental midline discrepancy remained. The posttreatment panoramic radiograph showed that the marginal bone loss in the maxilla was maintained. Posttreatment cephalometric evaluation showed an increased SNA angle, decreased SNB angle, and an increased ANB angle caused by upward and backward movement of the mandible following improvement of the CR-CO discrepancy. (Table 1) Decreased mandibular plane angle and facial height due to the upward movement of the mandible were observed. Regarding the dental relationships, the upper incisors were significantly lingually inclined, the lower incisors were labially inclined, and the interincisal angle

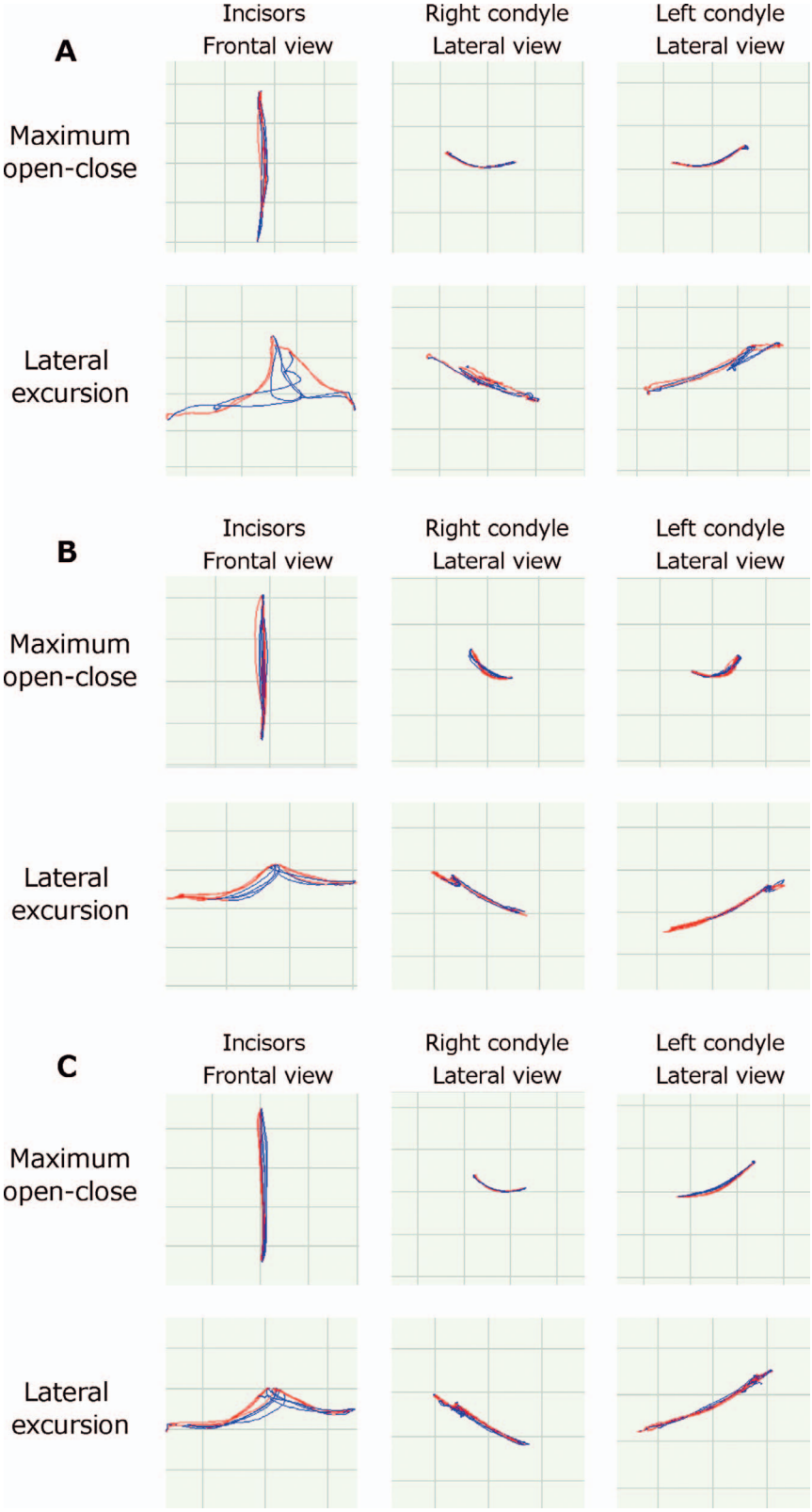

Figure 4. Condylar movements and incisal paths. The red line indicates the opening phase, and the blue line indicates the closing phase. (A) Initial. (B) Posttreatment. (C) Postretention.

Figure 5. Treatment progress during correction of the posterior scissor bite: (A) Start of treatment to upright the upper posterior segment. (B) Two months progress. (C) Five months. (D) Eight months. (E) 12 months.

Figure 6. Treatment progress during correction of the excessive overjet: (A) Start of lower arch leveling (same time at Figure 5E). (B) 24 months later. (C) 36 months. (D) 46 months.

was improved. Cephalometric superimposition showed that the lower incisors and molars were intruded, by up to 6.0 mm at the incisors (Figure 10). The root apex of the upper incisor was in proximity to the cortical bone of the nasal floor, and severe root resorption of the upper incisors was observed (Figure 11). Irregular movements of the incisal path and the bilateral condyles disappeared during lateral excursive jaw movements (Figure 4).

At the 13-month follow-up examination, a good facial profile and interdigitation were maintained, and slightly increased overjet and some space at the upper extraction site were observed (Figures 12–14). The skeletal position and jaw movements had largely been maintained (Figures 4, 15).

DISCUSSION

To improve the bilateral posterior scissors bite, vertical and transverse control of the posterior segments was necessary. This patient's bilateral scissors bite resulted from significant lingual tipping of the lower posterior segment and labial tipping of the extruded upper posterior segment. The increase of the occlusal height, uprighting of the premolars and molars in both arches, and lower arch expansion with upper arch constriction were needed to improve these problems. The increased occlusal height due to mandibular clockwise rotation had to be corrected during treatment in order to maintain the mandibular plane angle after achieving posterior occlusion. In previous reports, a segmented Le Fort I osteotomy and BSSO were reported to correct the vertical excess and maxillo-mandibular width discrepancy to achieve good esthetic-functional results.[1,7] However, some adult patients refuse surgical orthodontic treatment, as in the present case. In camouflage treatment for Brodie bite, some bite-opening appliance is essential to increase occlusal height. For growing patients, a maxillary removable biteplate and intermaxillary cross-elastics are recommended, but this requires excellent patient cooperation and mandibular growth.[2,3] Some case reports have shown successful treatment of unilateral scissors bite correction using miniscrew anchorage.[9,10] This mechanics can intrude and tip teeth easily without unwanted side effects and patient compliance. Therefore, a fixed lingual arch with anterior bite

Figure 7. Posttreatment facial and intraoral photographs.

block and posterior miniscrews was selected, and complete treatment of the bilateral scissors bite was achieved efficiently within several months. This mechanism may be preferable for improving bilateral scissors bite within a short treatment period without the need for patient cooperation.

The lower facial height could not be maintained in the treated patient. It is generally agreed that orthodontic treatment alone cannot always achieve ideal facial proportions and that increased lower facial height due to molar extrusion is unstable in adults because of muscle stretching.[11,12] Indeed, the lower facial height in the patient described temporarily increased due to the lingual arch with an anterior bite block, although the mandibular plane angle and lower facial height were finally decreased compared to the start value. This might have resulted from excessive masticatory force marked by the skeletal deep bite.[13] Additionally, the occlusal contact area was reduced by half from the initial assessment to posttreatment by the correction of the posterior scissors bite (Table 3). In contrast, the occlusal force was reduced by only about 10%. It may be deduced that excessive occlusal force was con-

Table 3. Changes in occlusal function[a]

	Initial	Posttreatment	Postretention
Occlusal force, N	743.0	657.0	671.0
Occlusal contact area, mm^2	23.0	11.5	13.2

[a] The occlusal force was recorded during maximum clenching.

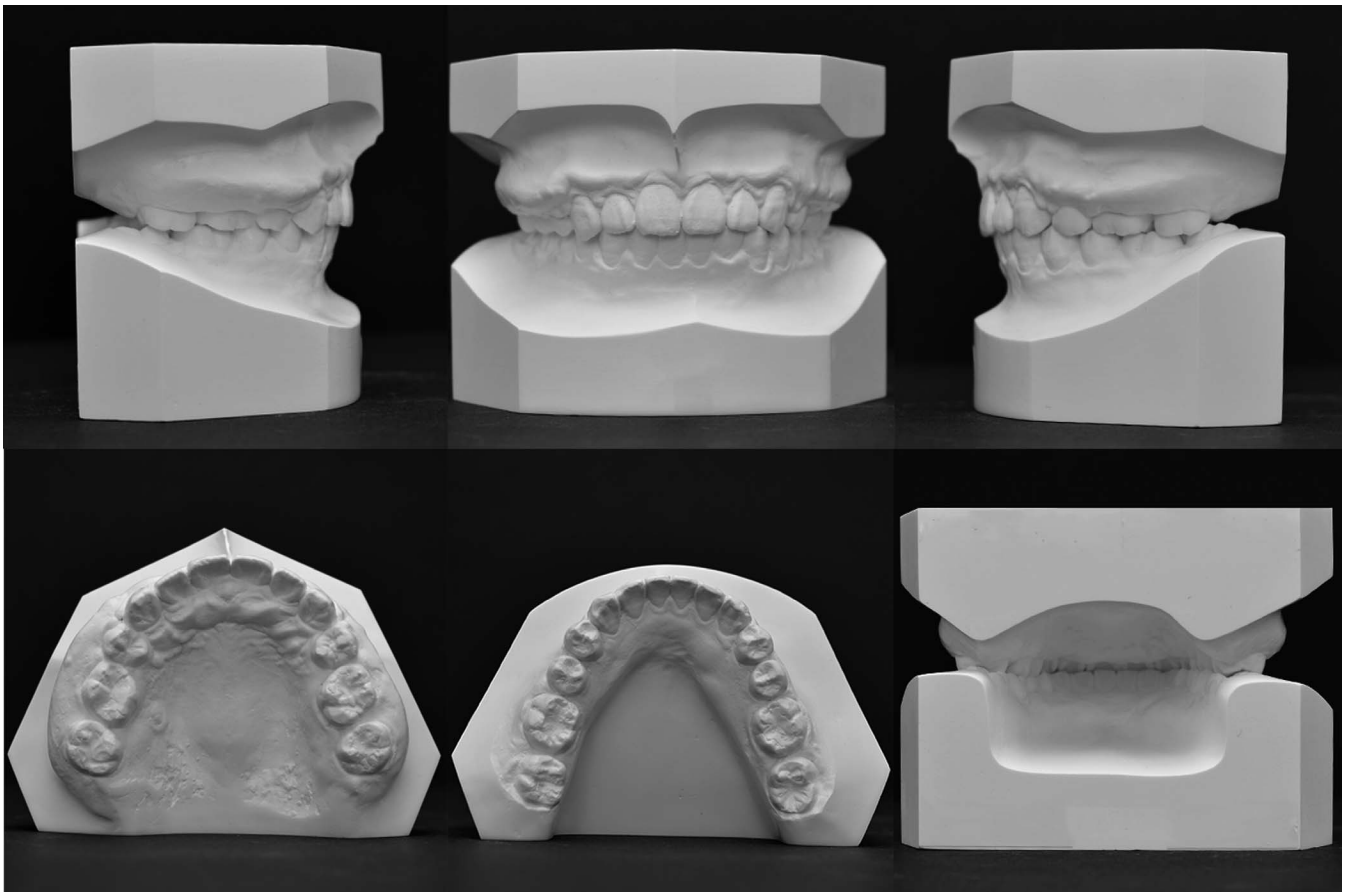

Figure 8. Posttreatment dental casts.

centrated in the molar area due to the decreased occlusal contact area and that the force intruded the posterior teeth. Therefore, vertical facial problems may be better improved by orthognathic surgery to rotate the body of the mandible downward for adult patients. Additionally, masseter surgical reduction may be considered in certain cases.

The correction of excessive overjet and overbite induced severe root resorption of the upper incisors. While the application of light force during anterior retraction and intrusion was employed to avoid root resorption expected with increased force levels,[14] the resorption might have been caused by excessive retraction with intrusion[15] and the long treatment duration.[14] In addition, a morphologic problem, in which the root apex of the upper incisor was in proximity to the cortical bone of the nasal floor, might have affected the resorption. In general, because root approximation to the palatal cortical plate causes root resorption of the upper incisors,[16] nasal cortical bone might influence the resorption as well. In contrast, the lower incisor roots were almost maintained, despite the marked intrusion. Although the type of vertical movement, such as intrusive movement, is a predictive factor for external apical root resorption,[17,18] orthodontic intrusion forces with torque control through the spongy bone of the symphysis may also contribute. The lower incisors should be further intruded to avoid severe root resorption of the upper incisors.

This is the first report of a clinical assessment of stomatognathic changes in a patient with bilateral posterior scissors bite. Tomonari et al. showed that lateral excursion on the scissors bite side was poor due to occlusal interferences in patients with unilateral posterior scissors bite.[19] In the current patient, lateral excursive jaw movements on both sides were irregular for incisor and bilateral condyle movements, and a CR-CO discrepancy was observed at initial presentation. As a result of treatment, satisfactory lateral excursive movements and CR-CO coincidence were achieved, and the maximum open-close movement was maintained. These findings suggest that the bilateral scissors bite disturbed the lateral jaw movements on both sides, and correction of such malocclusion might help to improve stomatognathic function.

The facial profile, improved interdigitation, and the arch width were largely stable with stomatognathic function at 13 months' retention. In general, dental

Figure 9. Posttreatment panoramic and cephalometric radiographs.

expansion of the lower arch is considered to be unstable over certain limits[20] and a greater change in arch form during treatment is associated with greater postretention changes.[21] Good interdigitation might help prevent the relapse of upper and lower posterior teeth inclinations. Regarding vertical relationships, the deep overbite was considered likely to relapse,[22] and a removable retainer incorporating a bite plane was recommended for retention.[23] Therefore, a removable retainer and a stabilization splint to prevent the overbite and arch form relapse was prescribed, and patient compliance was fortunately excellent all day. As a result, the vertical position of the upper and lower incisors and overbite was maintained. The amount of lower arch expansion, good interdigitation, and good patient compliance with regarding to using the retainer

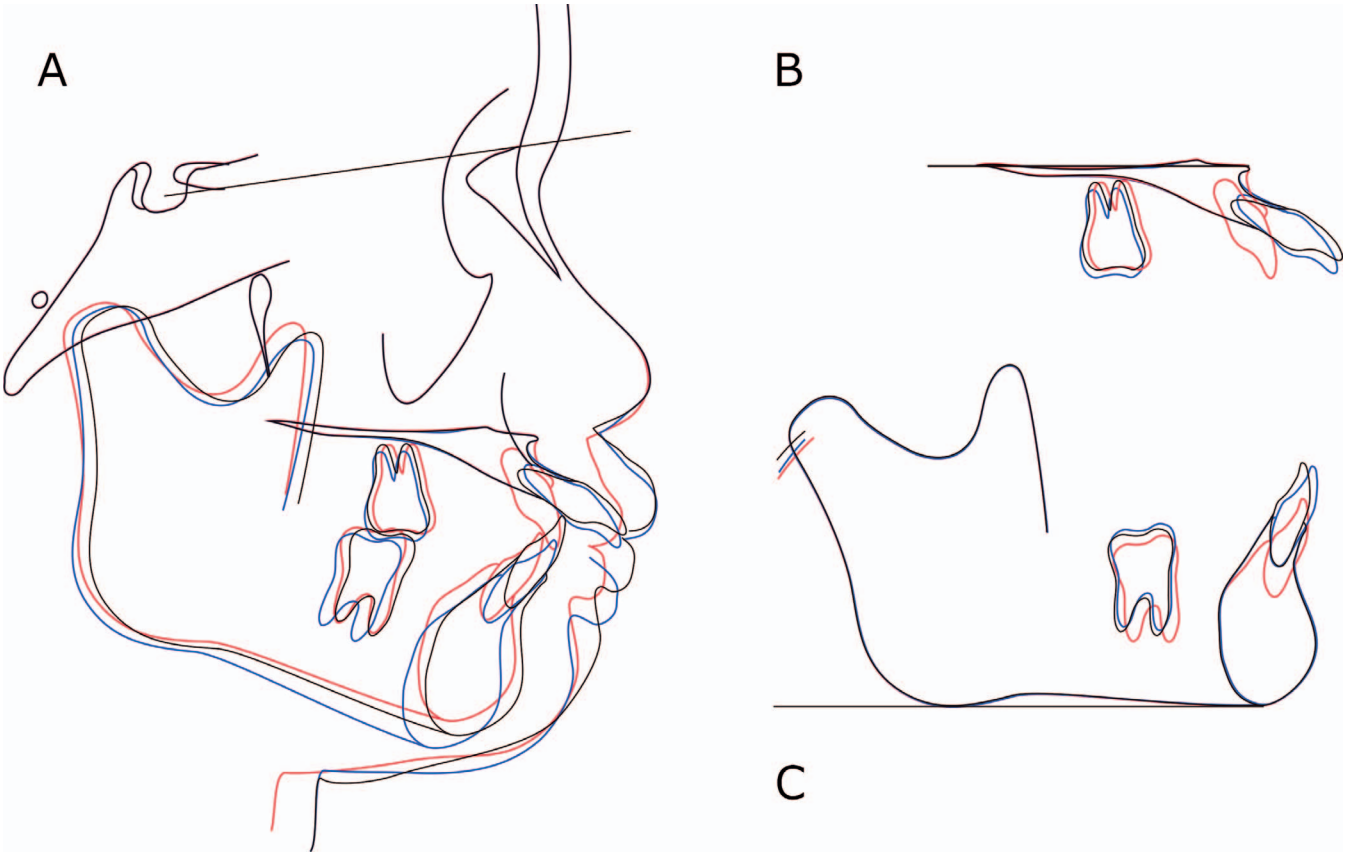

Figure 10. Superimposed cephalometric tracings (black: initial, blue: after correction of bilateral scissors bite, red: posttreatment.). (A) Sella-nasion plane at sella. (B) Palatal plane at ANS. (C) Mandibular plane at menton.

might have helped retain the satisfactory results of the bilateral scissors bite correction. However, 80% of deep bite patients with a short face tend to relapse at 2 years after treatment despite the use of a removable retainer.[24] Therefore, there is a need to follow up any changes in the long-term retention of this patient.

CONCLUSIONS

- In a patient who refused orthognathic surgery, nonsurgical orthodontic treatment with miniscrews and a fixed bite block was successful in treating a hypodivergent adult with Angle Class II division 1 malocclusion and bilateral scissors bite.

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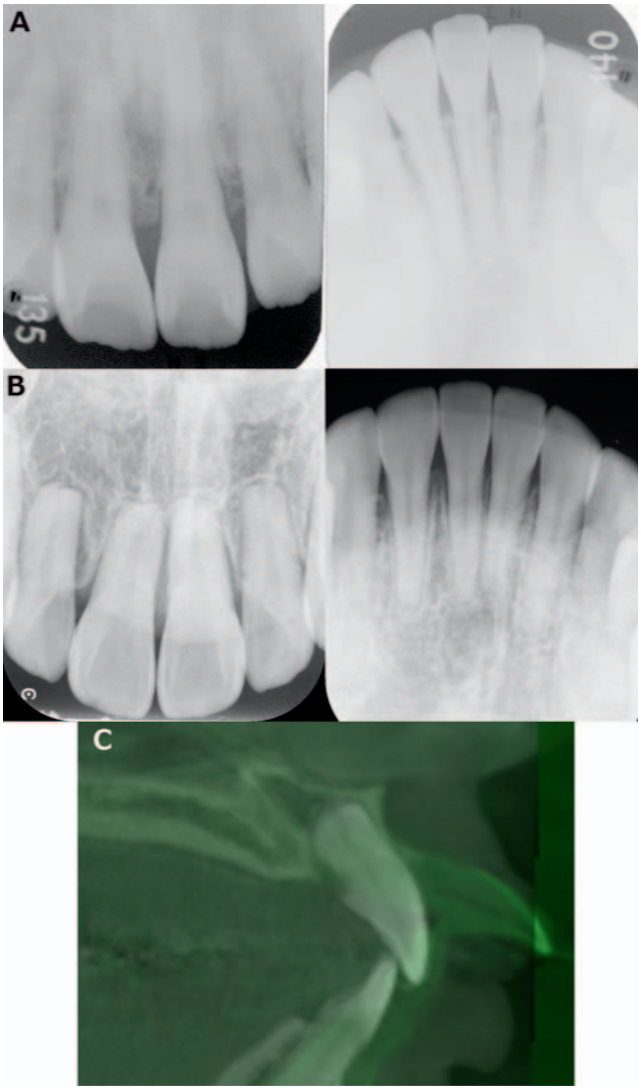

Figure 11. Changes in upper and lower incisor roots. (A) Initial dental radiograph. (B) Posttreatment dental radiograph. (C) Superimposed cone-beam computed tomography. (Green: initial, gray: posttreatment.)

Figure 12. Postretention facial and intraoral photographs.

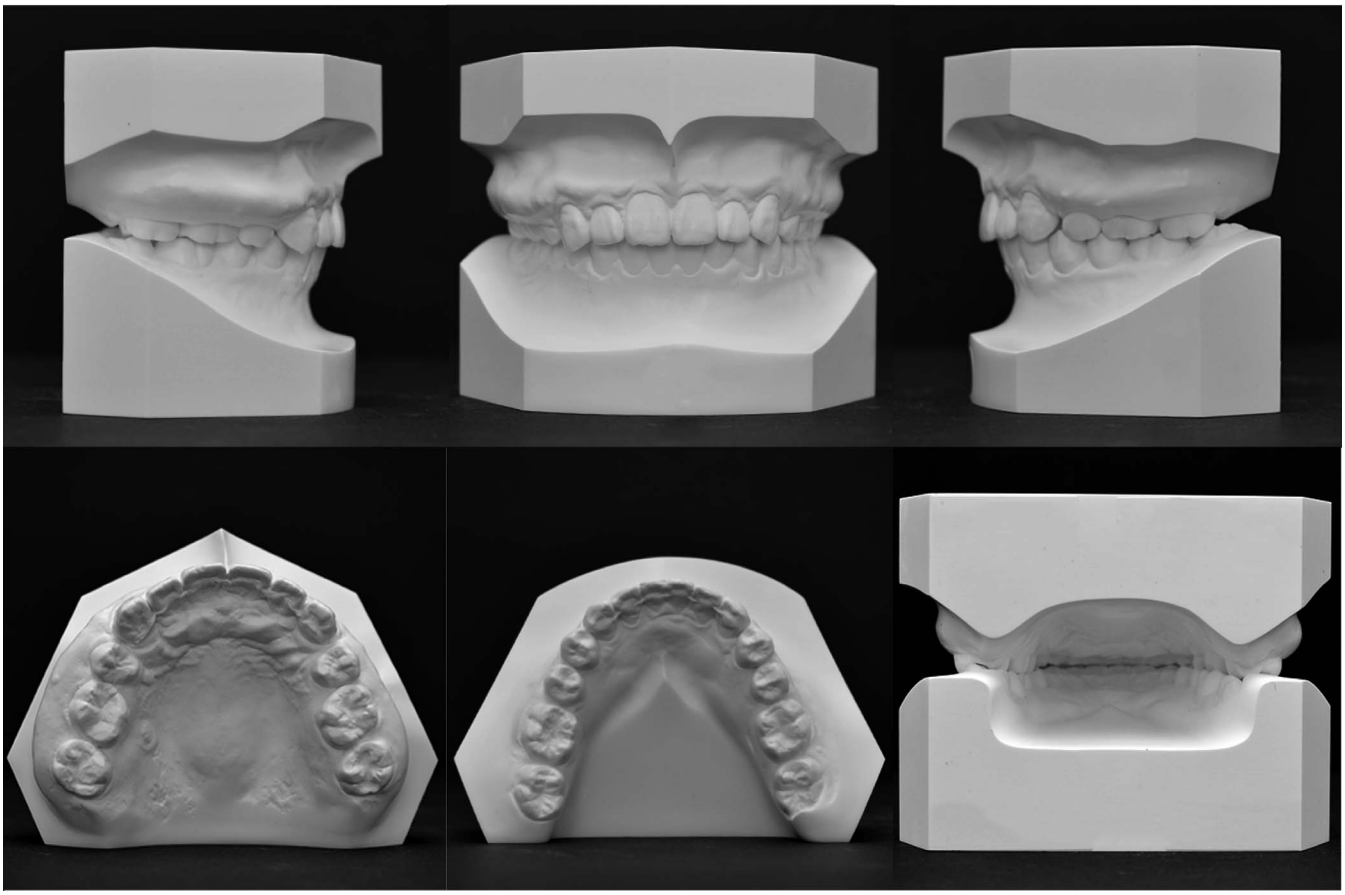

Figure 13. Postretention dental casts.

Figure 14. Postretention panoramic and cephalometric radiographs.

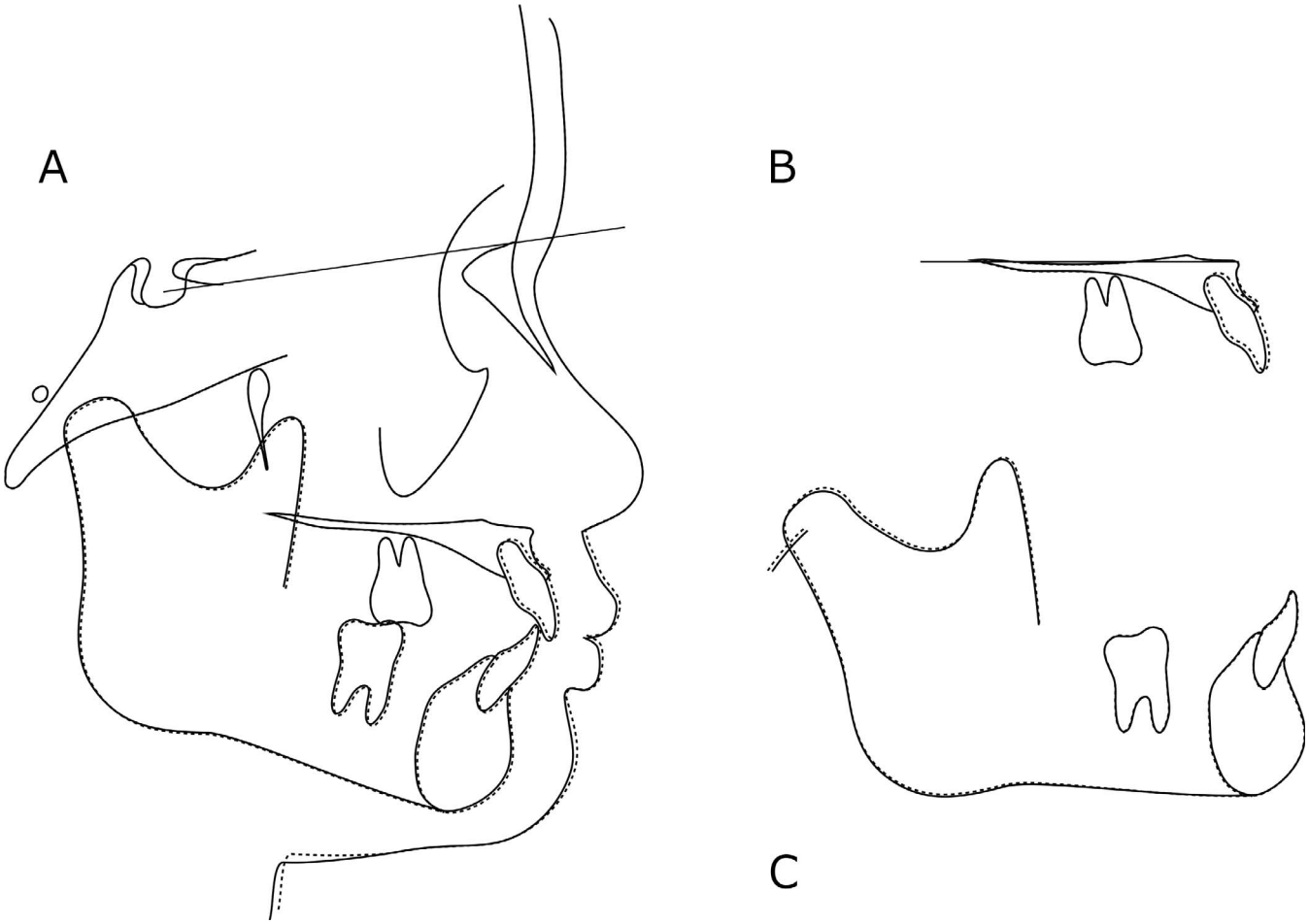

Figure 15. Superimposed cephalometric tracings (solid lines: posttreatment, dashed lines: postretention). (A) Sella-nasion plane at sella. (B) Palatal plane at ANS. (C) Mandibular plane at menton.