CASE REPORT

Nonsurgical correction of skeletal deep overbite and Class II Division 2 malocclusion in an adult patient

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Treatment modalities for Class II Division 2 malocclusion include growth modification, dental compensation, and surgical-orthodontic therapy; which treatment is chosen depends on the patient's age and growth potential. Deep overbite can be corrected by intrusion of anterior teeth, extrusion of posterior teeth, or a combination of both. Treatment considerations include the patient's facial profile, skeletal pattern, growth potential, and severity of dental malocclusion. Here, we present the nonsurgical orthodontic treatment of an adult patient with deep overbite and underlying skeletal Class II discrepancy. He had a hypodivergent facial pattern, Class II Division 2 malocclusion, and traumatic deep overbite due to supereruption of the mandibular anterior teeth. He refused orthognathic surgery but would accept orthodontic treatment alone, with the understanding that the treatment results could be compromised. We corrected the deep overbite by proclining the mandibular incisors; this helped to level the exaggerated curve of Spee. The posttreatment occlusion was significantly improved, both functionally and esthetically, with stable interincisal contacts. However, the improvement in occlusion and esthetics was achieved at the expense of reduced periodontal support for the mandibular anterior teeth. (Am J Orthod Dentofacial Orthop 2004;126:371-8)

A characteristic of Class II Division 2 malocclusion is retrusion of the maxillary incisors. The mandibular incisors are also often retruded and subsequently crowded. The palatal gingiva of the maxillary incisors can be subjected to trauma due to the deep overbite and the exaggerated curve of Spee.

When treatment to correct a deep overbite is planned, many factors should be considered, including esthetics, the occlusal plane, lip competence, the vertical skeletal dimension, skeletal convexity (A-B discrepancy), stability of final occlusion, and the patient's growth potential. A deep overbite can be corrected by genuine intrusion of the anterior teeth, extrusion of the posterior teeth, or a combination of intrusion and extrusion. The type of tooth movement depends on the treatment objectives.

Incisor intrusion is indicated to correct deepbite in a patient with a vertical maxillary excess, a large interlabial gap, a long lower facial height, or a steep mandibular plane. In a patient with a hypodivergent facial pattern, redundant lips, and a flat mandibular plane angle, the deep overbite could be corrected and facial esthetics improved by increasing the lower facial height, correcting lip redundancy, or increasing facial convexity. Molar extrusion in growing patients will increase lower anterior facial height and allow favorable mandibular growth, and stability is fairly good. However, molar extrusion is not recommended for adult patients, because the stability is highly questionable.[1]

Here we present a challenging situation: an adult patient with a hypodivergent facial pattern and a traumatic deep overbite due to supereruption of the mandibular anterior teeth. He rejected a combined surgical-orthodontic treatment, preferring orthodontic treatment alone. We developed a nonsurgical orthodontic treatment plan to relieve anterior crowding by proclining the incisors, especially in the mandibular arch, and to level the anterior and posterior occlusal planes in the mandibular arch by correcting the deep overbite.

CASE HISTORY

The patient, a 42-year-old man, had a chief complaint of malalignment of the anterior teeth and impingement of the palatal gingiva by the mandibular incisors. He was also concerned about some missing

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Fig 1. Pretreatment intraoral photographs.

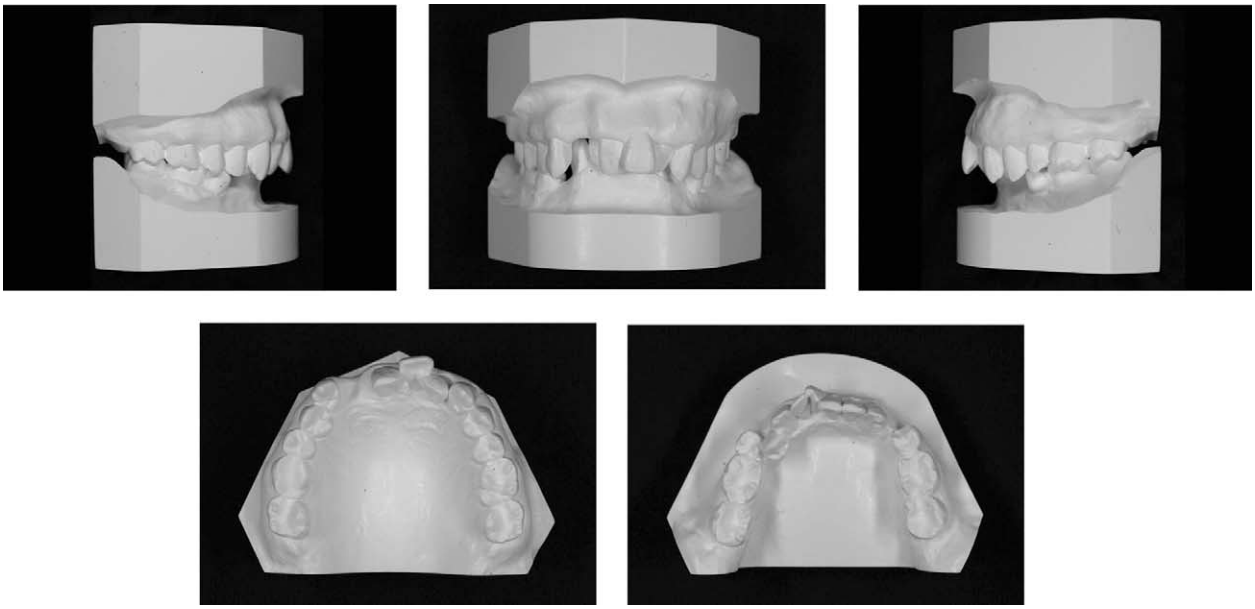

Fig 2. Pretreatment dental models.

teeth—the maxillary right lateral incisor and the mandibular right first premolar. His goals were alignment of the anterior teeth and prosthodontic reconstruction of the missing teeth.

DIAGNOSIS

The patient had a straight profile with a prominent chin, protrusive lips, and deep labiomental fold (Figs 1-4). A dental Class II Division 2 malocclusion with 2-mm overjet and 100% overbite was noted. The deep overbite was associated with supererupption and retroclination of the mandibular anterior teeth. The maxillary and mandibular incisors were retroclined, resulting in mandibular incisor crowding and an increased interincisal angle. The cephalometric analysis showed a Class II skeletal pattern with a low mandibular plane angle and retroclined maxillary and mandibular incisors (Fig 3, Table). A hypodivergent skeletal pattern was characterized by the long mandibular ramus and square gonial angle. The

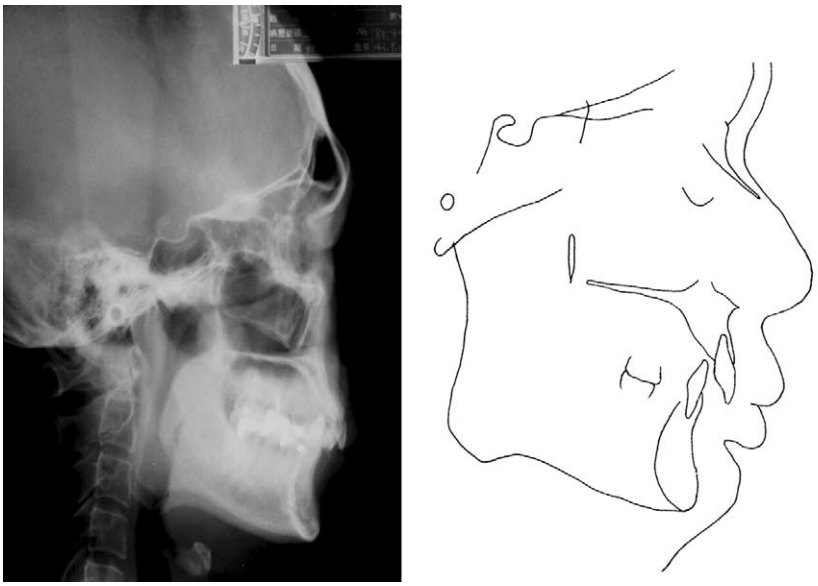

Fig 3. Pretreatment cephalogram and tracing.

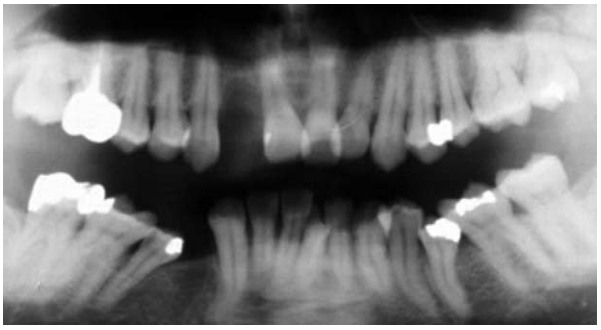

Fig 4. Pretreatment panoramic radiograph.

mesial tipping of the mandibular right second premolar was due to the missing first premolar.

TREATMENT OBJECTIVES AND ALTERNATIVES

The optimal treatment plan for this patient would combine comprehensive orthodontic treatment with orthognathic surgery. Mandibular ramus surgery could rotate the mandible slightly forward and downward to increase lower anterior facial height, and orthodontic leveling of the mandibular dentition could be performed more easily after surgery. This treatment plan was offered to the patient, but he refused surgery. Without surgical intervention, the treatment plan would have to rely on increasing dental camouflage by labial tipping of the mandibular incisors to relieve crowding and establishing an interincisal occlusal stop. However, too much dental camouflage can threaten periodontal health. After a thorough discussion, the patient still preferred the orthodontic treatment plan, with the understanding that the final result would not be optimal and could include loss of periodontal support of the mandibular anterior teeth.

Table. Cephalometric analysis

	Pretreatment	*Posttreatment*	*Retention*
Skeletal			
SNA (°)	86.5	85.5	86.0
SNB (°)	80.0	78.5	79.0
ANB (°)	6.5	7.0	7.0
A-Nv (mm)	4.5	3.5	4.0
Pog-Nv (mm)	−5.0	−6.0	−5.5
MP-SN (°)	18.0	18.5	19.0
PP-MP (°)	5.0	5.0	6.0
Dental			
U1-SN (°)	90.0	98.0	94.0
U1′-NPog (mm)	7.5	10.5	9.5
U1-L1 (°)	159.5	117.5	134.0
L1-MP (°)	93.5	127.0	114.0
L1′-NB (mm)	2.0	10.0	8.0
L1/NB (°)	10.0	44.5	32.0

S, sella; *N*, nasion; *A*, A-point; *B*, B-point; *Nv*, nasion vertical; *Pog*, pogonion; *MP*, mandibular plane; *PP*, palatal plane; *U1*, maxillary incisal axis; *L1*, mandibular incisal axis; U′, maxillary incisal edge; L′, mandibular incisal edge.

TREATMENT PROGRESS

Fixed appliances (.018 × .025-in slot) were placed in the maxillary arch. To regain space for the missing maxillary right lateral incisor, the anterior teeth were tipped labially with a .018-in stainless steel wire with

Fig 5. Fixed appliance therapy.

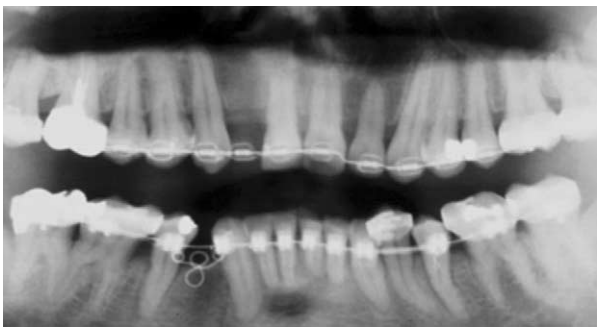

Fig 6. Progress radiograph.

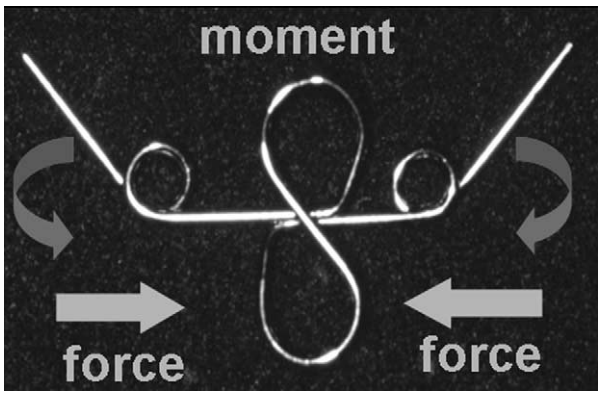

Fig 7. Double-helix spring. Terminal ends of activated spring were inserted into vertical slots on canine and second premolar brackets.

an omega loop mesial to the buccal attachment of the maxillary first molars. This archwire was replaced with a .016 × .022-in stainless steel wire with a compensating curve. When sufficient space for the lateral incisor had been attained, a resin tooth was added to maintain the space (Figs 5 and 6). Eventually, an upper intrusive beta-titanium[2] .017 × .025-in archwire was used to facilitate bite opening.

A biteplate was used during bonding of the mandibular dentition to prevent detachment of the anterior brackets. Alignment and leveling of the mandibular dentition were initiated with a .016 × .022-in copper nickel-titanium (Ni-Ti) wire, followed by .016 × .022-in beta-titanium wire; a .016 × .022-in stainless steel wire was used in the finishing stage. The residual space from the mandibular right first premolar was used to relieve anterior crowding. The right canine was moved distally with a double-helix spring, constructed of .018-in wire (Fig 7). The terminal ends of this activated spring were inserted into vertical slots on the canine and second premolar brackets. The moment produced by this spring could counteract the tendency for crown tipping and facilitate root movement. Leveling of the mandibular dentition occurred simultaneously with space closure and labial tipping of the anterior teeth.

At the end of treatment, the posterior occlusion had good intercuspation. The molar and canine relationships on the left side were Class I. However, the canine relationship on the right side was finished into a Class II relationship because of the missing mandibular right first premolar. The pretreatment curve of Spee was leveled by labial tipping of the mandibular incisors (Figs 8-12).

Fig 8. Posttreatment intraoral photographs.

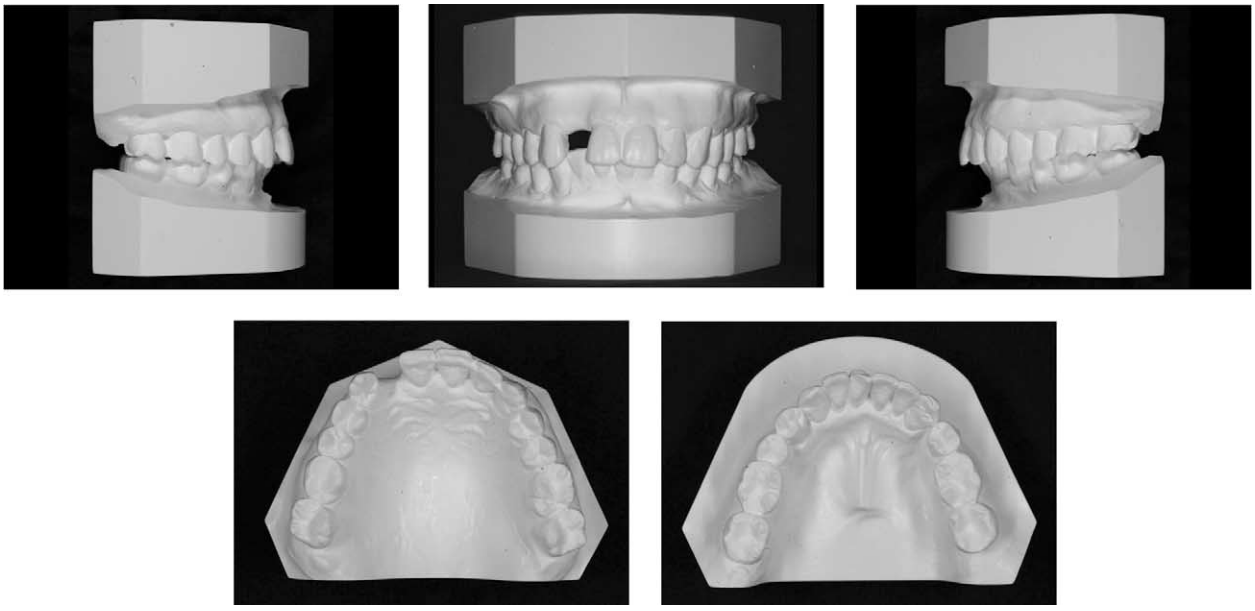

Fig 9. Posttreatment dental models.

Circumferential retainers were worn during the retention phase. To maintain the space regained for the maxillary right lateral incisor, a lingual fixed retainer was bonded to the adjacent incisors. A resin tooth was added to the upper retainer to temporarily restore function and esthetics. Finally, a single-tooth implant prosthesis was constructed by the prosthodontist (Fig 13). The lingual fixed retainer was not used in the mandibular arch to facilitate interproximal plaque control of the periodontally compromised anterior teeth.

TREATMENT RESULTS

The total treatment time was 2 years 6 months. Although this was longer than usual, the patient was satisfied with the result. The curl of the lower lip was reduced by the reduction of the overjet and a slight increase in lower facial height. The final occlusion was improved, both functionally and esthetically. A Class I molar and Class II canine relationship was produced on the right side because space from the missing right first premolar was used to relieve mandibular incisor crowd-

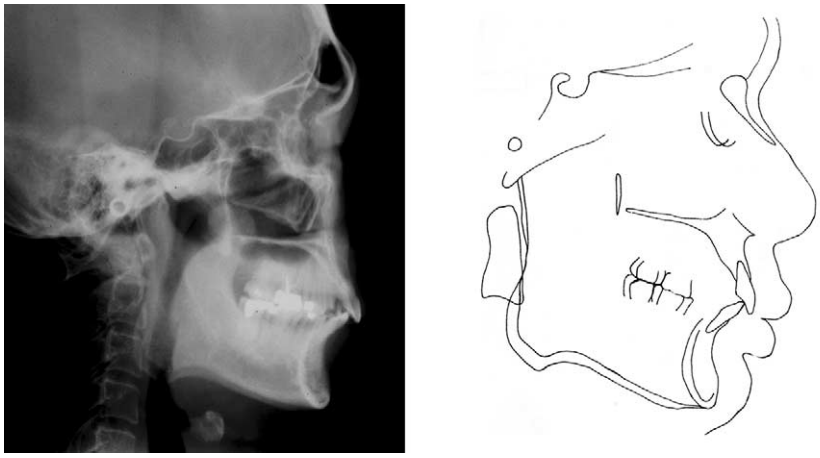

Fig 10. Posttreatment cephalogram and tracing.

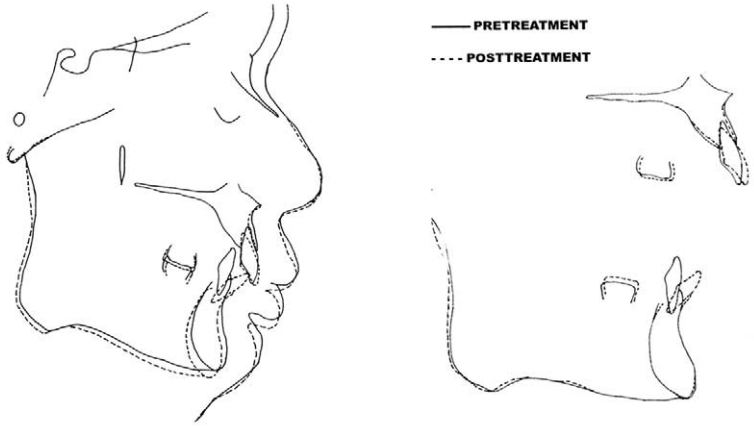

Fig 11. Pretreatment and posttreatment cephalometric tracings superimposed on relatively stable anatomical structures of maxilla and mandible.

Fig 12. Posttreatment panoramic radiograph.

ing. Orthodontic correction of the mandibular arch included leveling of the occlusal plane, a decrease in the interincisal angle, and establishment of an occlusal stop.

Superimposition of pretreatment and posttreatment cephalometric tracings showed that the maxillary incisors and molars remained unchanged vertically; however, the mandibular incisors were tipped labially (Fig 11). This movement resulted in a slight improvement in the deep labiomental fold. This was not tooth intrusion, but it did create the effect of bite opening. Radiographically, the root paralleling was generally acceptable, but a reduced alveolar bone level was noted in the anterior teeth. Moreover, root resorption of the mandibular incisors was significant (Fig 14). The short root length evident on the posttreatment panoramic radiograph could be due to excessive labial tipping of the mandibular incisors.

The treatment result was generally stable during the 1.5-year retention phase, although minor rotation of the mandibular left central incisor occurred. The long-term

Fig 13. Postretention intraoral photograph, showing single-tooth implant restoration.

stability of the mandibular alignment would be better with a lingual fixed retainer.

DISCUSSION

Patients with skeletal deepbite generally have a long mandibular ramus, a square gonial angle, a short nose-to-chin distance, and deficient lower anterior facial height. Bite opening in growing patients with a horizontal growth pattern requires molar extrusion to produce clockwise rotation of the mandible. However, increasing the lower facial height by molar extrusion might not be stable in adults, because of muscle stretching.[3] Consequently, surgical-orthodontic therapy is recommended for adult patients with severe skeletal deepbites. The vertical dimension can be increased by mandibular ramus surgery to rotate the body of the mandible downward.

Correction of a deep overbite can be achieved by molar extrusion, incisor intrusion, or a combination of both kinds of tooth movement. In this adult patient, intrusion of the anterior teeth was the treatment of choice for correcting a deep overbite. Should overbite reduction for this patient be aimed at maxillary incisor intrusion? It was important to maintain rather than intrude the maxillary incisors because the patient initially had a normal amount of incisor show at rest. The inferior positioning of the mandibular incisal edges was produced by anterior tipping of the teeth during leveling. An archwire with a reverse curve of Spee placed an intrusive force on the mandibular incisors anterior to the center of resistance, resulting in labial proclination.

For this patient, extracting the mandibular left first premolar helped relieve the mandibular space deficiency. The orthodontic management of crowding should be based on esthetics, lip competence, vertical skeletal dimension, and anteroposterior skeletal pattern. For this patient, an advantage of nonextraction treatment was increased lip fullness and flattening of the deep labiomental fold. The residual space from the missing mandibular right first premolar was used to relieve crowding of the mandibular incisors. Acceptable overjet and a Class II canine relationship on the right side were achieved, in part, at the expense of mandibular incisor proclination. The Class II canine relationship did not result in canine guidance during lateral excursion. Consequently, "group function" was established on the right.

Fig 14. Posttreatment periapical radiograph of mandibular incisors.

During the initial leveling stage, a Ni-Ti wire with a reverse curve of Spee was used in the mandibular arch. The Ni-Ti wire could be fully engaged into the bracket slots of the malaligned teeth. The gentle force delivered by the Ni-Ti wire progressively leveled the anterior and posterior occlusal planes. The mandibular incisors were proclined by this archwire with a reverse curve of Spee. An archwire with an accentuated curve was also applied to the maxillary dentition to procline the maxillary incisors and regain space for the lateral incisor. The force system created by the reverse curve of Spee delivers an intrusive force to the incisors and an extrusive force to the molars and premolars. Because extrusion is more easily accomplished than intrusion, a reverse curve of Spee wire should extrude posterior teeth with minimal anterior intrusion. Extrusion of posterior teeth is stable in growing patients because mandibular condylar growth allows for dentoalveolar growth. However, posterior tooth extrusion in an adult is probably counteracted by the posterior occlusion, especially in a patient with a hypodivergent skeletal pattern. Increasing lower anterior facial height in adult patients by molar extrusion is not advisable.

The interincisal angle might play a critical role in the stability of deep overbite correction. Riedel[4] suggested that a large interincisal angle at the end of treatment was associated with relapse of deep overbite. The study of Burzin and Nanda[5] showed that the axial inclination of the incisors and the overbite did not change significantly during a 2-year posttreatment observation period. They suggested that ideal axial inclination of the incisors at the end of treatment could be a factor in overbite stability. In Class II cases, proper palatal root torque of the maxillary incisors plays an important role in maintaining a normal interincisal angle and establishing anterior occlusal stop.[6] Orthodontic treatment of adult patients with Class II malocclusions with skeletal deepbite must include labial tipping of the mandibular incisors to camouflage the mandibular retrusion. Labial tipping over the basal bone can help achieve an acceptable overjet and overbite. However, proclined mandibular incisors could need permanent retention to ensure long-term stability.

The deep overbite in this patient was due to the retroclined mandibular incisors, which produced an increased interincisal angle. The mandibular dentition was leveled by proclining the anterior teeth to correct the deepbite and decrease the interincisal angle. This treatment plan was chosen because of the facial profile, the amount of crowding, the vertical skeletal pattern, and the periodontal condition. Excessive labial tipping of the mandibular incisors could partially explain the significant shortening of root length seen on the posttreatment panoramic radiograph.

The position of the mandibular incisors plays an important role in establishing ideal overjet and overbite. Positioning the mandibular incisors upright over basal bone should improve the stability of the result. Labial movement of the mandibular incisors could also result in progression of mucogingival problem[7] and loss of alveolar bone. Another contraindication to incisor proclination is undesirable facial esthetics. A floating norm of mandibular incisor inclination has been proposed for patients with anteroposterior discrepancy between jaw bases.[8] The mandibular incisors could be proclined more in patients with hypodivergent skeletal patterns and prominent chins.[9] Rapid labial tipping of mandibular incisors should be avoided to minimize the risk of root resorption and bone dehiscence, especially on a narrow symphysis with questionable labiolingual width of the alveolar bone.[10] Narrow alveolar bone widths have been found both labial and lingual to the mandibular incisors of nongrowing subjects with hyperdivergent patterns and high sella-nasion (SN)-mandibular plane (MP) angle but not in those with hypodivergent faces and low SN-MP angles.[11] For this patient, the prominent chin and thick symphysis were associated with an extreme hypodivergent facial pattern and facilitated proclination of the mandibular incisors.

This patient had open gingival embrasures between the maxillary incisors after orthodontic treatment. These embrasures were probably due to the triangular tooth shape and reduced periodontal support.[12] The root angulation of the maxillary incisors was not the major problem. The open embrasures were caused primarily by the periodontal bone loss and the triangular tooth shape, which is usually associated with shorter and more incisally positioned interproximal contacts.[13] A more esthetic treatment outcome for this patient could have been achieved by reshaping the maxillary incisors through flattening the contact and closing the embrasure space.

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