Case Report: Nonsurgical treatment of an adult with severe anterior open bite

A malocclusion characterized by open bite and vertical maxillary excess can be one of the most difficult problems to correct through orthodontic treatment because of the difficulty in permanently changing the morphological disharmony and/or functional disorder associated with open bite. However, in some patients with less severe skeletal impairment it may be possible to orthodontically correct the occlusal disharmony so that the new relationship of the dental arches becomes compatible with normal function of the oral environment. Stability may be enhanced if mechanics are used which do not extrude posterior teeth.

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A malocclusion characterized by open bite is one of the most difficult malocclusions to treat because it is the result of the interaction of multiple etiological factors.[1-4] Open bite is frequently associated with other malocclusions, such as anterior-posterior, transverse, or vertical discrepancies.[1-8] When associated with other skeletal malocclusions, open bites can be especially difficult to control following treatment if the vertical jaw relationships are increased by dental extrusion.[9] Lack of stability of the extruded anterior teeth is a widely recognized cause of relapse. Because a posterior open bite is usually associated with functional disorders and habits including tongue thrust during swallowing, digit habits, or anterior tongue position, the functional disorder frequently persists indefinitely following orthodontic treatment.[9] This may be especially true in adults, thus making the retention phase extend indefinitely.

This case report follows the treatment of an adult patient with a Class II Division 1, subdivision malocclusion and a skeletal open bite and describes a technique to correct the open bite without increasing the posterior vertical dimension.

Case history

A woman, 20 years 6 months old, whose chief complaint was that her "front teeth did not touch" was referred for orthodontic treatment. The patient was a student nurse with a familial history (father) of maxillary protrusion. She had a history of thumb sucking until 3 years of age.

Clinical examination

The patient's face appeared symmetrical from the front. In the lateral view, the upper lip was protrusive and the mandible severely retrognathic (Figure 1).

Intraoral photographs showed a severe anterior open bite with 6 mm overjet and 7.5 mm open bite. Oral examination showed pronounced tongue thrust during swallowing. The first molars were in Class I occlusion on the right side and end-on Class II on the left side (Figure 2). The bite was open from the second premolars anteriorly.

Figure 1A-B Pretreatment facial photographs.

Figure 1A

Figure 1B

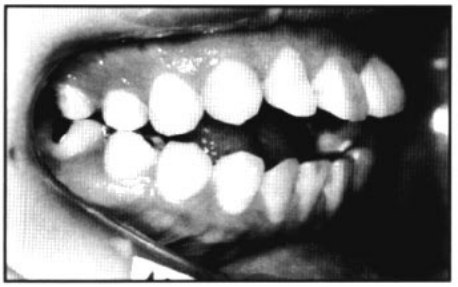

Figure 2A

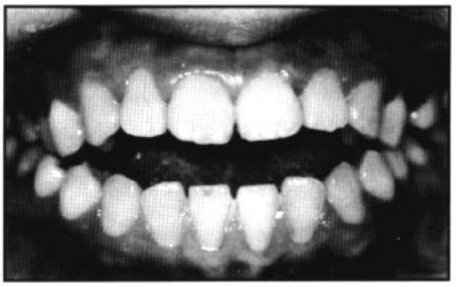

Figure 2B

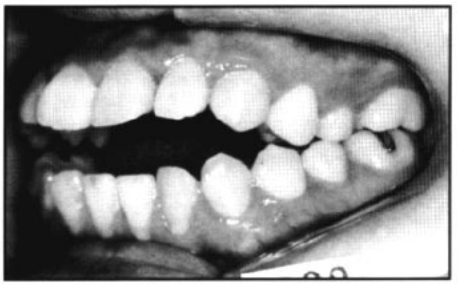

Figure 2C

Figure 2A-E
Pretreatment intraoral photographs. Overjet 6 mm; openbite 7.5 mm

Figure 3
Pretreatment panoramic radiograph shows condylar deformation of both right and left condyles.

Figure 4
Linear and angular measurement pretreatment (age 20 years 7 months), posttreatment (age 24 years 8 months), and postretention (age 26 years 1 month).

Figure 2D

Figure 2E

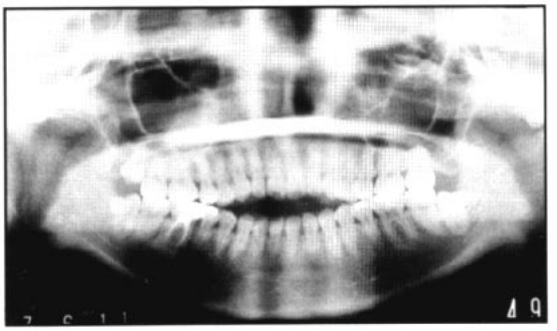

Figure 3

No clicking, joint pain, limitation or deviation of opening was found at the initial examination. However, the patient did have a history of moderate pain in her left masseter muscle region on one occasion approximately 5 years earlier.

Analysis of the study models showed that both dental arches were well aligned and within normal limits in length and width. Using Ootsubo's chart[11] as a standard, the patient's tooth sizes were found to be within normal limits in the maxillary arch, but larger than normal in the mandibular arch.

Radiographic examination

A panoramic radiograph showed one missing maxillary left third molar and short roots of the maxillary and mandibular second premolars (Figure 3). In addition, the panoramic radiograph and the lateral headfilm showed deformation of the condyle on both the right and left sides according to Schiller's Method[10] of analysis.

Linear	20 y 7 m	24 y 8 m	26 y 1 m
N-S	67.6	67.9	68.1
N-ME	127.1	126.4	127.3
A'-Ptm'	52.5	52.5	53.1
Is-Is'	27.4	29.4	30.3
Mo-Ms	21.3	20.8	22.2
Gn-Cd	106.8	107.3	107.5
Pog'-Go	79.0	78.9	79.7
Cd-Go	45.0	44.2	44.9
Ii-Ii'	43.1	47.3	47.1
Mo-Mi	36.5	36.0	36.1
Overjet	6.1	3.1	3.9
Overbite	-7.5	0.5	0.1
Angular			
SNA	82.8	82.7	82.9
SNB	73.0	74.9	73.9
ANB	9.8	7.8	9.0
U-1 to SN	114.7	102.2	101.6
L-1 to Mand.	104.4	100.3	100.2
Y-axis (SN)	78.6	77.2	77.5
FMA	37.8	37.0	37.1
IMPA	104.4	100.3	100.2
FMIA	37.8	42.6	42.7
ODI	77.6	74.4	76.3

Figure 4

Cephalometric analysis

Linear analysis of the lateral cephalometric radiograph showed that although the total length of the face (N-Me) was within normal limits, upper face height (N-Ans) was increased. Maxillary length was also increased (A'-Ptm') and the maxillary molars were in mesioversion (Ptm'-Me). Although the length of the body of the mandible (Pog'-Go) was within normal limits, the

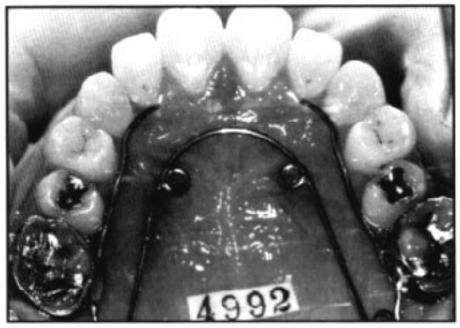

Figure 5A

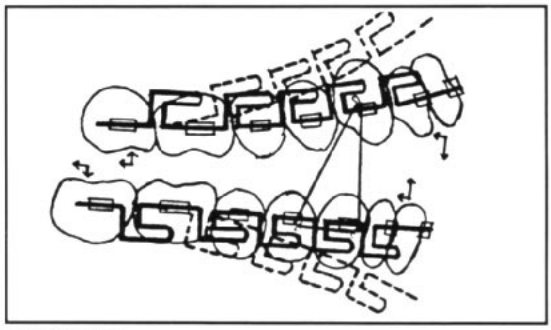

Figure 5B

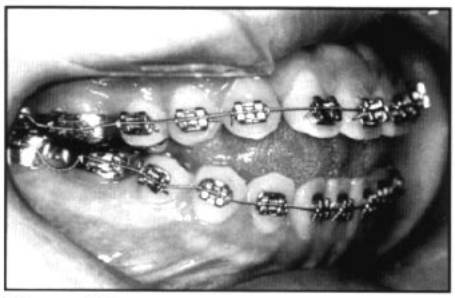

Figure 6A

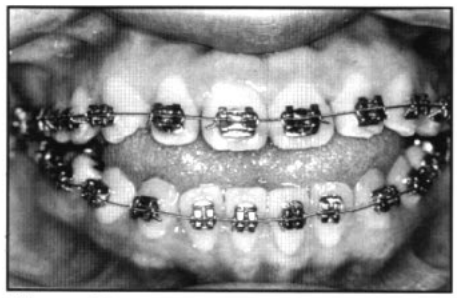

Figure 6B

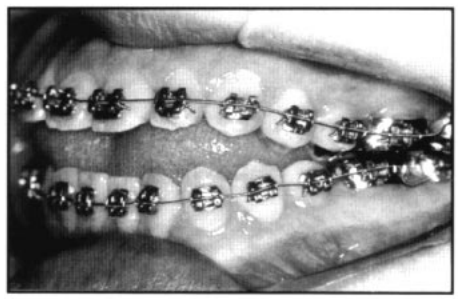

Figure 6C

length of the ramus (Gn-Cd) was shorter than normal.

Angular analysis of this radiograph showed that although the position and size of the maxilla (SNA) was within normal limits, the mandible was severely retrognathic (SNB). There was bimaxillary dentoalveolar protrusion as evidenced by proclination of the maxillary and mandibular incisors. There was an increase in the vertical jaw relationship in addition to an increased mandibular plane angle (FMA) (Figure 4). Although the skeletal relationships revealed a retrognathic mandible, there were marked dentoalveolar compensations to a Class I occlusion on the right side and to an end-on Class II occlusion on the left side.

Diagnosis and treatment plan

The orthodontic diagnosis was a Class II, division 1, subdivision, malocclusion with a skeletal open bite and tongue thrust during swallowing.

The goals of orthodontic treatment were to: 1) reduce protrusion by retraction of the anterior teeth; 2) expand the maxillary arch; 3) extrude the maxillary and mandibular anterior teeth until an acceptable overbite-overjet relationship was achieved; 4) prevent extrusion of the posterior teeth; and 5) develop Class I buccal relationships.

A Le Fort I osteotomy with orthodontic treatment was considered the most effective treatment to reduce the protrusion for this patient because of the severe disharmony in the skeletal pattern. However, the patient declined this approach.

A quad helix appliance was used initially to correct the lingual cross-bite by lateral expansion of the maxillary arch in the premolar region (Figure 5A). The biomechanical basis of appliances used is shown in Figure 5B. Full, standard .018 x .025 edgewise appliances were then placed in both arches and leveling was accomplished with light continuous (.0175) archwires (Figure 6A-C). Although overjet and overbite showed a slight reduction after 6 months, a severe open bite remained. To close the open bite, two multiloop .016 x 0.22 stainless steel archwires with vertical elastics were used to extrude the anterior teeth and to intrude posterior teeth for the correction of overjet and overbite (Figures 7- 9). The three remaining impacted third molars were removed to provide space for the anticipated distal tipping and intrusion of the molars.

Treatment was extended beyond the anticipated time because the patient was not compliant initially. Active treatment time was 36 months. No TMJ dysfunction or symptoms were present during or after the active treatment period. After removal of the edgewise appliances, two circumferential removable retainers were used full-time, except when eating, for 10 months. The patient was then instructed to wear the retainers at night only. However, she completely stopped wearing them within 2 months.

Treatment results

A comparison of profile photographs taken at the beginning and at the end of the treatment

Figure 5A-B
A: Lateral expansion of the maxillary arch with modified quad helix.
B: The biomechanical basis of the appliances. Before insertion, the maxillary archwire shows a marked curve of Spee and the mandibular archwire a marked reverse curve. After insertion, vertical elastics were used full-time to extrude the anterior teeth and to intrude the posterior teeth for the correction of the overjet and overbite.[14]

Figure 6A-C
Edgewise appliances in both the maxillary and the mandibular arches. The leveling of both arches was started.

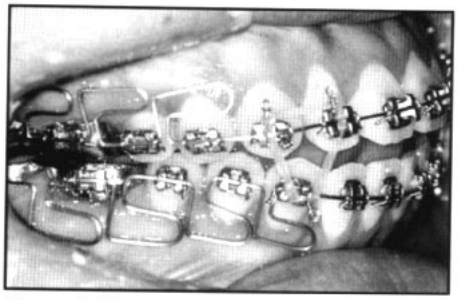

Figure 7A

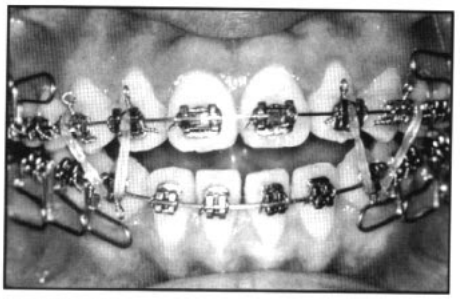

Figure 7B

Figure 7C

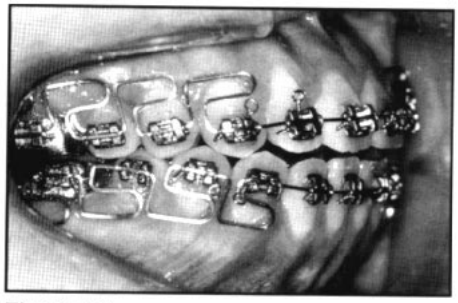

Figure 8A

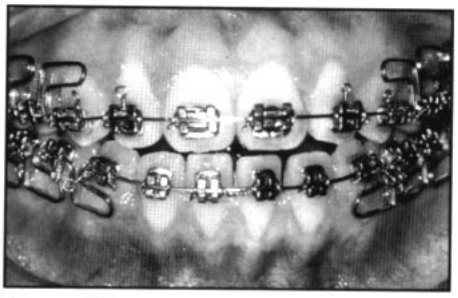

Figure 8B

Figure 8C

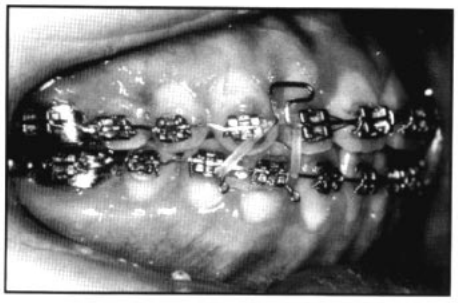

Figure 9A

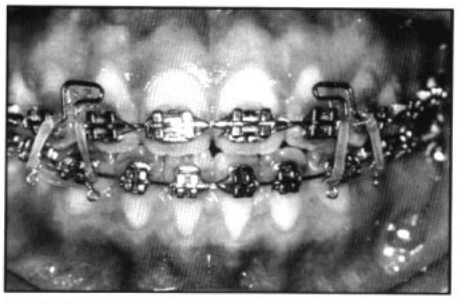

Figure 9B

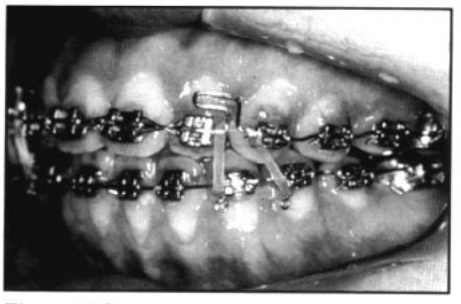

Figure 9C

Figure 7A-C
Multiloop archwires were used for bite closure.

Figure 8A-C
Treatment progress. Overjet and overbite almost corrected.

Figure 9A-C
Intraoral relationship of the maxillary and the mandibular arches during final adjustment of the occlusion.

Figure 10A-B
Posttreatment facial photographs.

Figure 10A

Figure 10B

Figure 11A

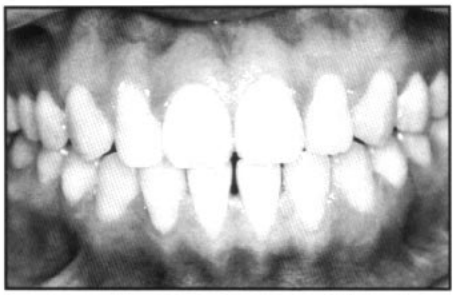

Figure 11B

Figure 11C

Figure 11D

Figure 11E

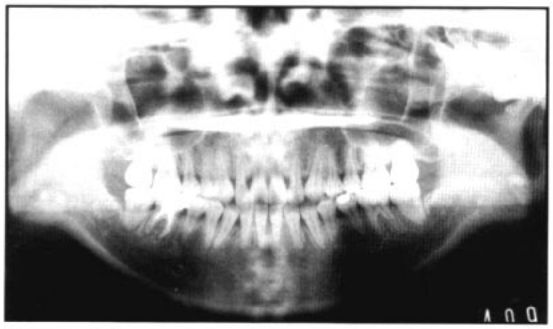

Figure 12

Figure 11A-E
Posttreatment intraoral photographs showing good occlusal relationship between the maxillary and mandibular arches.

Figure 12
Posttreatment panoramic radiograph. The deformation of the right and left condyles did not progress further during the active treatment period.

Figure 13
Superimposition of pretreatment and posttreatment cephalometric tracings.

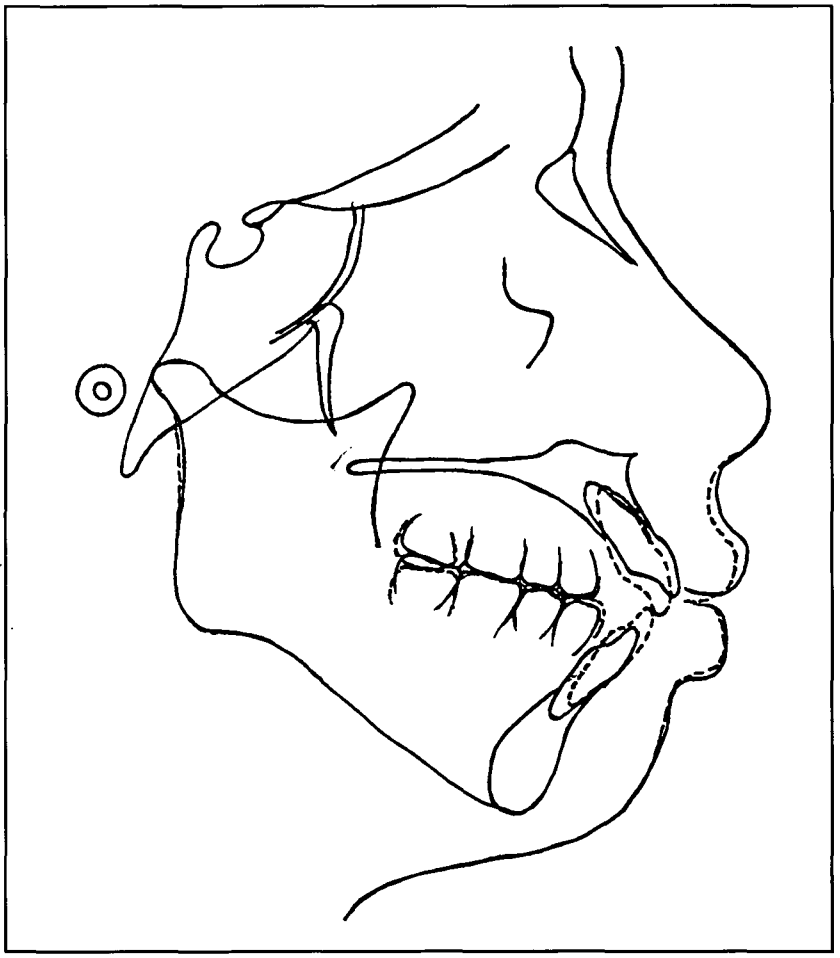

Figure 13

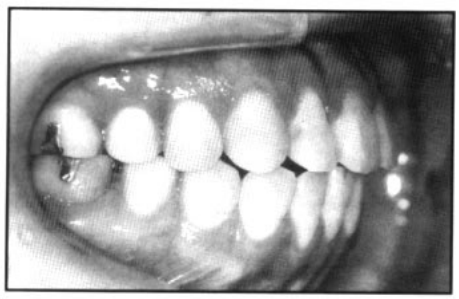

Figure 14A

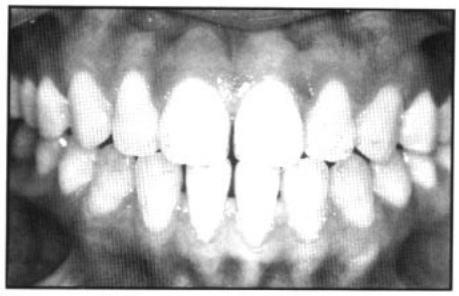

Figure 14B

Figure 14C

Figure 14A-E
Postretention intraoral photographs.

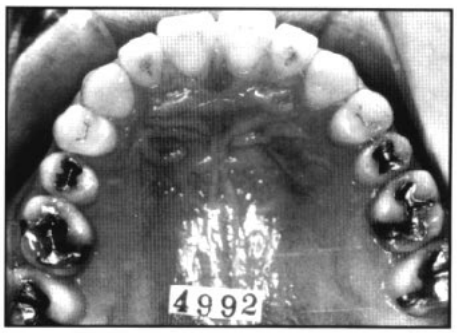

Figure 14D

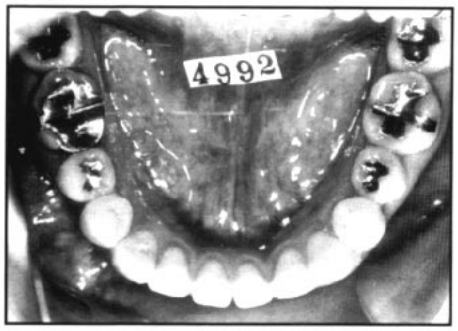

Figure 14E

showed that the lip incompetence was eliminated and protrusion was reduced slightly (Figure 10A-B). Both overjet and overbite were improved and a bilateral Class I occlusal relationship was attained (Figure 11A-E). The posttreatment panoramic radiograph disclosed no caries, root resorption, periodontal bone loss, or changes in condylar form (Figure 12). Approximately 2 mm of gingival recession occurred on the labial aspect of each of the mandibular central incisors.

Cephalometric analysis at the beginning and at the end of active treatment showed that overjet decreased from 6 mm to 3 mm and overbite increased from -7.5 mm to +1 mm. The SNB angle increased from 73° to 74.9°, resulting in the anteroposterior apical base relationship (ANB) to decrease slightly from 9.8° to 7.8°. Both the maxillary and mandibular incisors were uprighted (U-1 to SN and mandibular incisor to mandibular plane respectively) and the mandibular plane angle decreased slightly from 37.8° to 37° (Figure 13, Figure 4).

Postretention evaluation

Two years after active treatment (Figure 14A-E), cephalometric analysis showed minimal change. The occlusion remained in a Class I relationship with normal overjet; however, the overbite was minimal.

Discussion

This case report documents the successful orthodontic treatment of an adult patient with a severe skeletal Class II malocclusion characterized by an open bite. When planning treatment for skeletal problems of this magnitude, combined orthodontic treatment and orthognathic surgery are usually recommended. In this case, the patient was treated only with orthodontic therapy because she refused surgery.

A multiloop edgewise archwire technique was used to extrude the anterior teeth while exerting distal uprighting forces on the posterior teeth. This technique has previously been described,[14] but information has not been available on the sta-

bility of this method. Although full-time use of vertical box elastics was recommended in the anterior region, treatment was prolonged because initially the patient was not able to use the elastic bands full-time. As a result, the active treatment period lasted 3 years.

Correction of a skeletal open bite associated with vertical maxillary excess is one of the most difficult problems to correct surgically. Even greater difficulty can be expected in treating and gaining stability in an open bite which has maxillary dentoalveolar protrusion and a retrognathic mandible. The most likely reason for the instability is that the mandible frequently rotates backward in response to extrusion of posterior teeth[7,16-18] especially with the use of intermaxillary elastic bands. Although the pretreatment mandibular plane angle was severely increased in this patient, the mandibular plane actually closed slightly (FMA). If the mandible had rotated backward during treatment, the anterior teeth would have needed to extrude even more to correct the open bite, which in turn may have resulted in even less stability.

Although no premolars or molars were extracted in this case, the necessity of extracting these teeth was considered because of protrusion of the maxillary teeth and lip incompetence. However, even though the extraction of these teeth may have made the correction of protrusion easier, extractions were avoided because this patient also had a tongue thrust during swallowing. The tongue thrust may have made retention of the corrected occlusion more difficult because any retraction of the anterior teeth could have violated the tongue space.[19-23] Additional stability may have also been achieved in this patient's treatment because oral myofunctional therapy[24-25] was used to minimize the effects of anterior tongue position and tongue thrust during swallowing.

Stability of the posttreatment occlusion was acceptable for this patient during the first year of active retainer wear and during the second year when no retainers were worn. In general, stability is the most important criteria in choosing an acceptable method of treatment for open bite. Many previous studies have indicated that if open bite correction is not stable, it is because the tongue continues to be postured anteriorly which causes the bite to reopen.[1-8] The successful repositioning of the tongue from the myofunctional therapy program and the mechanics used may have collectively provided the degree of stability seen in this patient. However, long-term stability cannot be determined for this treatment method until multiple consecutively treated patients have been followed for years.

Gingival recession was also seen in this patient labial to the mandibular central incisors. This may have been the result of mild gingival inflammation present throughout treatment,[26] extrusion of the anterior teeth to increase the dental compensation,[26] or because of the thin gingival tissue and root prominence present initially.[27]

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