Case Report

Severe Anterior Open Bite Malocclusion with Multiple Odontoma Treated by C-Lingual Retractor and Horseshoe Mechanics

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Abstract: A fixed lever arm appliance called C-lingual retractor was placed on the lingual aspects of the maxillary anterior teeth in a 16-year-old male patient with a Class II anterior open bite malocclusion. The treatment plan consisted of extracting both upper first premolars and retracting the upper six anterior teeth. A multiple odontoma between the lower left lateral incisor and canine was surgically removed before orthodontic treatment, and a horseshoe appliance was used in the lower dentition for intermaxillary anchorage during the bone-healing period. The transpalatal arches soldered to the upper first and second molar bands were used as an intra-arch anchor unit for upper-space closure. Class II elastics were used buccally between the upper six anterior teeth and the lower horseshoe appliance. We took 13 months to treat the open bite malocclusion. There was a decrease in lip fullness as the upper anterior teeth were retracted, which contributed to a decrease in facial convexity. The treatment result was maintained six months after debonding. Details of the new appliance, clinical procedures, and treatment changes are presented. (*Angle Orthod* 2003;73:206–212.)

Key Words: C-lingual retractor; Lever arm appliance; Horseshoe appliance; Open bite; Multiple odontoma; En masse retraction

INTRODUCTION

An anterior open bite is a definite lack of contact, in the vertical direction, between the incisal edges of the maxillary and mandibular anterior teeth.[1] Many treatment modalities such as habit-breaking appliances, high-pull headgears, chin caps, vertical elastics, Multiloop edgewise arch wire (MEAW) appliances, tongue reduction, and surgical correction are used to treat open bite malocclusions.[2–4] In some cases of Class II anterior open bite malocclusion, bicuspid extraction aids in bite closure,[5] but precision mechanics are needed, and accurate and known forces and moments should be used.

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The C-lingual retractor

To achieve direct translation, a single force directed at the center of resistance is needed.[6]

The C-lingual retractor developed by Chung et al[7] is made of a 0.032-inch stainless steel spring wire soldered to mesh brackets. It is an alternative method for obtaining a direct controlled retraction force on the maxillary anterior teeth.[6,8–11] A hook is bent in the wire so that the line of action of the force passes through the center of resistance (Figure 1A). The retractor is adjusted to the palatal surface and is bonded to the lingual surface of the anterior teeth. Transbond (3M-Unitek Co, Monrovia, Calif) is preferred in addition to the customary bonding adhesive to resist the shearing forces that occur when loading the retractor.[6] Two nickel-titanium closed coil springs (Ormco/''A'' Company, Orange, Calif) are used as a power source, which is stretched palatally from the retractor to the soldered hook of a transpalatal arch (TPA). A TPA, made of 0.9-mm stainless steel wire, is needed for the intra-arch anchorage unit and the desired direction of force (Figure 1B).

It is the kind of segmental arch wire technique reported by Park et al[11] that uses only the C-lingual retractor for tooth movement with the anterior and posterior teeth consolidated into separate units with stiff wires. Because no

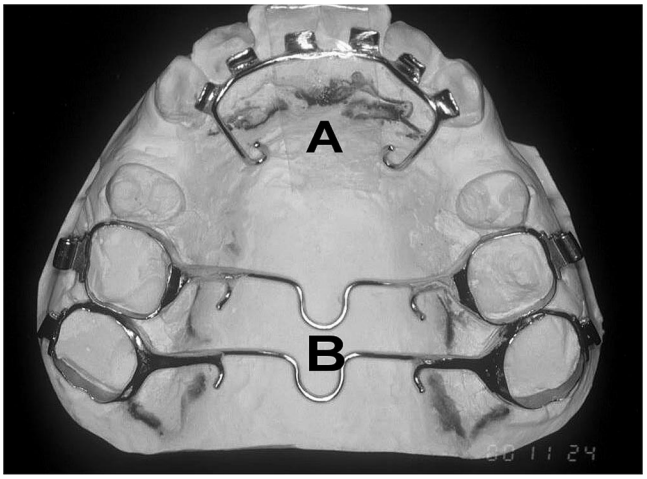

FIGURE 1. (A) The fixed lever arm appliance named C-lingual retractor; (B) transpalatal arch soldered.

friction is introduced, precise calibration and accurate tooth movements are possible.[12]

In this case report, we describe the treatment of a male patient with a Class II anterior open bite malocclusion who had multiple odontoma in the lower left dentition, using a C-lingual retractor and horseshoe mechanics. The clinical and radiographic changes are described.

CASE REPORT

Pretreatment evaluation

The extraoral examination revealed the facial characteristics typical of a Class II anterior open bite patient with a convex profile, excessive interlabial distance, and an everted lower lip (Figure 2). The intraoral examination revealed a severe overjet and an anterior open bite with a Class II dental relationship in both the canine and molar regions. There was no occlusal centric relationship discrepancy upon closure. Temporomandibular joint function was normal. There was no occlusal contact between teeth 14 and 24. The maxillary and mandibular midline coincided with the facial midline despite the presence of a lower anterior crowding (Figures 2 and 3). The patient's chief complaint was a lack of incising ability with the anterior teeth.

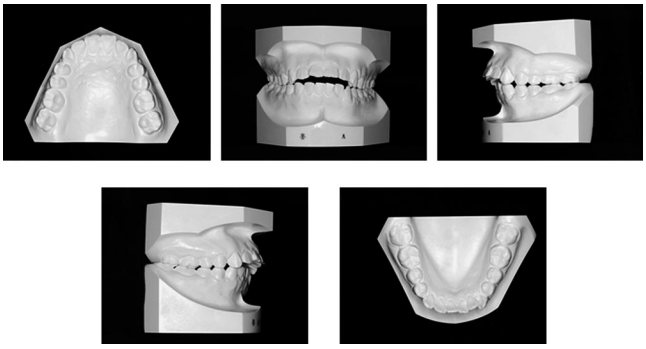

FIGURE 3. Pretreatment study models.

The radiographic examination revealed that the patient had a convex profile with an ANB angle of 8°, a retrognathic mandible (SNB and SN-Pg angle, 69°), a steep mandibular plane (FMA, 36°; SN-OP angle, 25°), and protrusive incisors (interincisal angle, 103°; maxillary incisor to NA angle, 32°; maxillary incisor to NA distance, 12 mm; mandibular incisor to NB angle, 38°; mandibular incisor to NB distance, 15 mm) (Figure 4A). The panoramic X-ray showed that multiple odontoma was presented between teeth 32 and 33 (Figure 4B).

Treatment plan

The patient and his parents refused any surgical treatment options and requested only conventional orthodontic treatment. We made two tentative diagnostic setup models by our own method,[13] which showed the treatment result of C-lingual retractor (Figure 5A) and the final occlusion (Figure 5B). This allowed us to determine the amount of retraction needed, to measure arch width discrepancies present, and to accurately calculate the amount of protrusion needed. Therefore, we decided to extract the upper first premolars to correct the anterior open bite and to establish a Class I

FIGURE 2. Pretreatment extraoral and intraoral photographs.

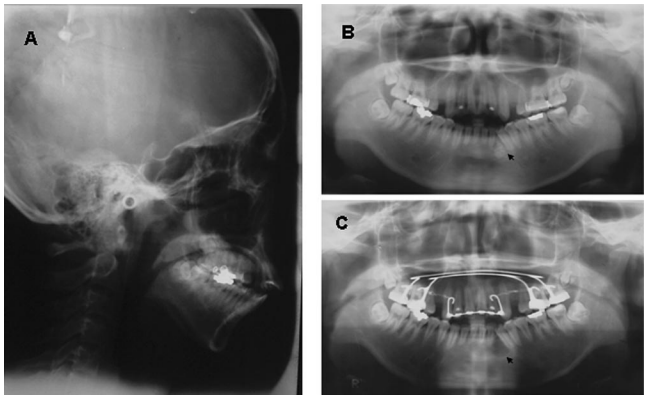

FIGURE 4. (A) Pretreatment cephalometric radiograph; (B) pretreatment panoramic radiograph with multiple odontoma present; and (C) after multiple odontoma removal.

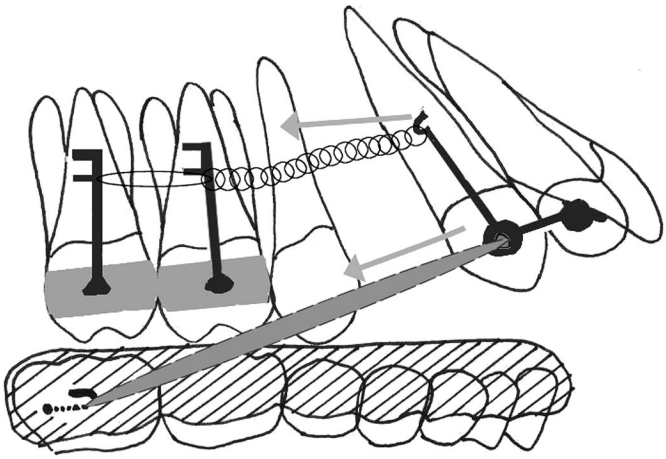

FIGURE 6. Diagram of C-lingual retractor and horseshoe appliance anchorage.

canine relationship, followed by placement of C-lingual retractor and Class II mechanics using a lower horseshoe appliance. The diagram of the retraction mechanics is shown in Figure 6.

Treatment progress

Treatment was initiated with the removal of the impacted multiple odontoma between teeth 32 and 33 (Figure 4C) and both upper first premolars, followed by the buccally segmented placement of 0.022- × 0.028-inch preadjusted arch wire appliance. TPAs were soldered to the lingual aspects of both upper molar bands. The C-lingual retractor was placed onto the upper six anterior teeth and was used for five months until the space was closed. Two clear buttons were bonded to the labial surface of the upper canines and were used as the hooks for the Class II traction. The horseshoe appliance was used to supplement the anchorage and to apply Class II elastics (1/4′, 3.5 ounces) (Figure 7A). The patient was instructed to wear the horseshoe appliance 10 hours a day to reinforce anchorage. At the cessation of C-lingual retractor therapy, routine orthodontic mechanics were initiated to complete treatment (Figure 7B,C). The mandibular arch was treated in a traditional way. After six months of leveling, the fixed appliances were all removed, and a tooth positioner was used for finishing. The changes of the maxillary dentition during treatment period are shown in Figure 7D.

The total active treatment time was 13 months. Upper and lower removable Hawley retainers were delivered to maintain the results of treatment.

Treatment results and discussion

After treatment, this patient showed a Class I canine relationship and a full Class II molar relationship with a concomitant midline discrepancy. The incisors were not procumbent. The lips were competent in repose, and the soft tissue profile was harmonious even though the chin position was still retrusive (Figures 8 and 9).

Cephalometric analysis showed that FMA changed a lit-

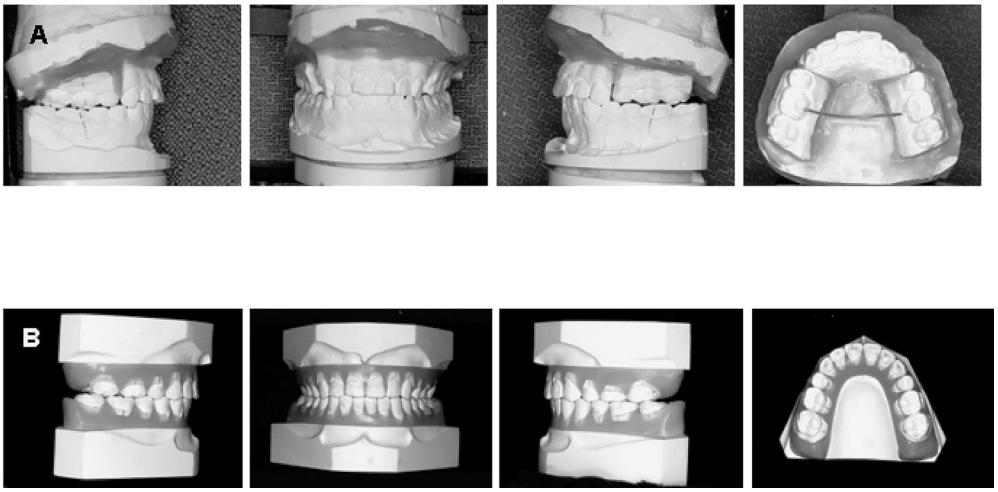

FIGURE 5. (A) Diagnostic setup model of en masse retraction of upper six anterior teeth; (B) tentative diagnostic setup model.

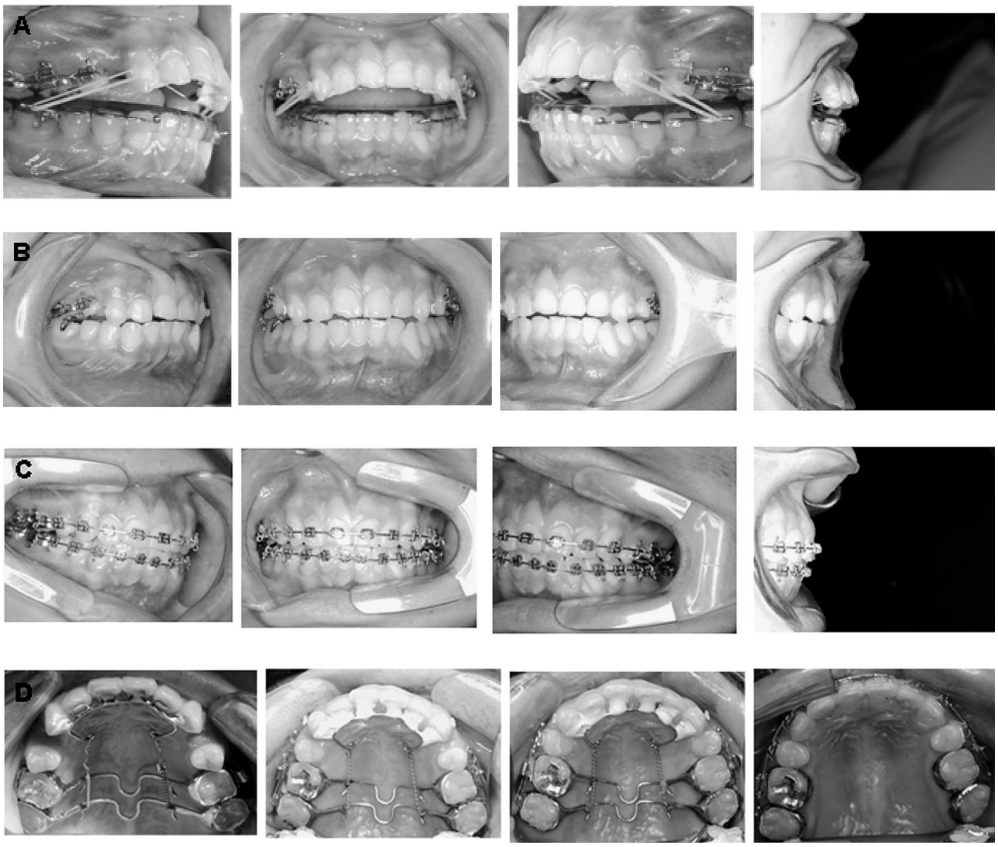

FIGURE 7. Intraoral photographs of treatment progress. (A) Lower horseshoe appliance delivered; (B) after lingual retraction of upper six anterior teeth: both upper second premolars were intruded by poor stabilization of posterior segments; (C) upper and lower leveling; and (D) occlusal view of orthodontic treatment.

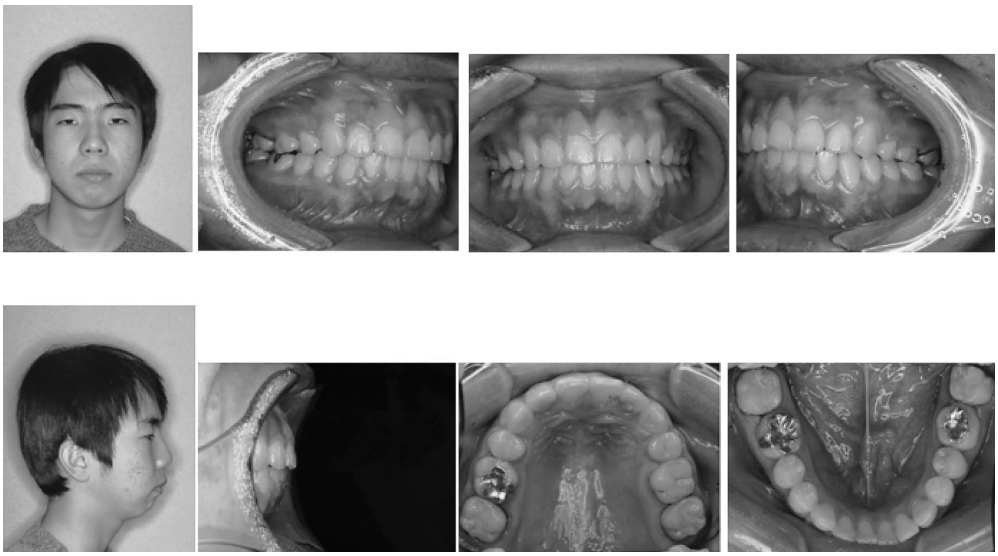

FIGURE 8. Posttreatment extraoral and intraoral photos.

tle from 36° → 37.5° (Figure 10; Table 1). The backup with the horseshoe appliance can be assumed to have produced an intrusive force to the upper molars, which minimized any steepening of the mandibular plane. The skeletal anchorage system for lower molar intrusion can be helpful in rotating the mandible counterclockwise.[14] The occlusal plane changed a little after treatment because of the upper anterior teeth moving down (SN to OP angle, 25° → 27°).

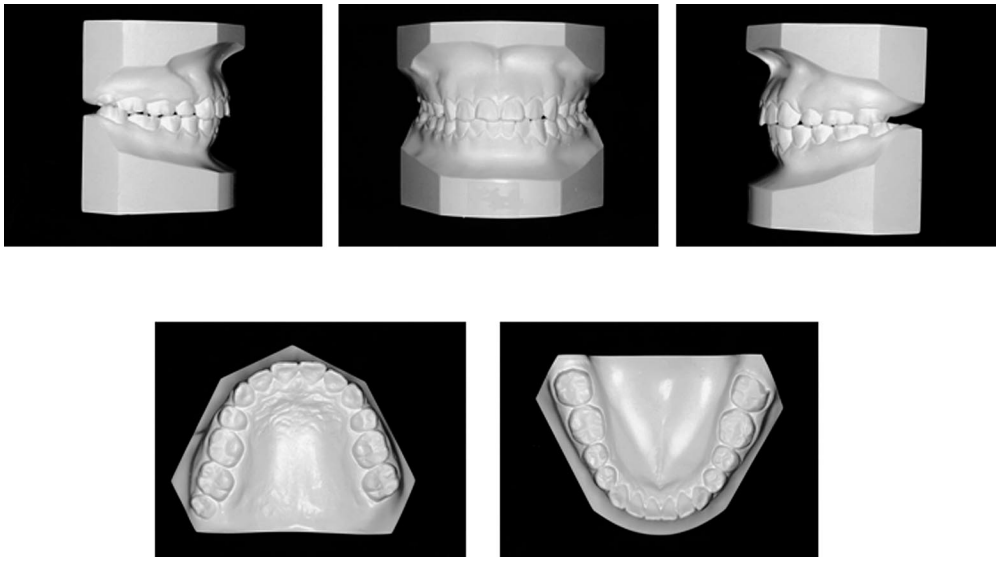

FIGURE 9. Posttreatment study models.

The upper incisors were noticeably retracted (FH-U1 angle, 116° → 100°; maxillary incisor to NA distance, 12 mm → 6 mm; maxillary incisor to NA angle, 32° → 17°). The lower incisors were uprighted and maintained (IMPA, 105° → 103.5°; FMIA, 39° → 39°; mandibular incisor to NB distance, 15 mm → 14 mm; mandibular incisor to NB angle, 38° → 38°). The lips were competent in repose even though they were full (upper lip to E-plane, 8 mm → 5 mm; lower lip to E-plane, 10 mm → 6 mm). The interincisal angle was improved (103° → 118°). The ANB changed a little during treatment (SNA, 77° → 75°; SNB, 69° → 68.5°). Radiographically, the lower left canine displayed an intact root and proper root inclination. The treatment outcome in this patient was quite acceptable, and he

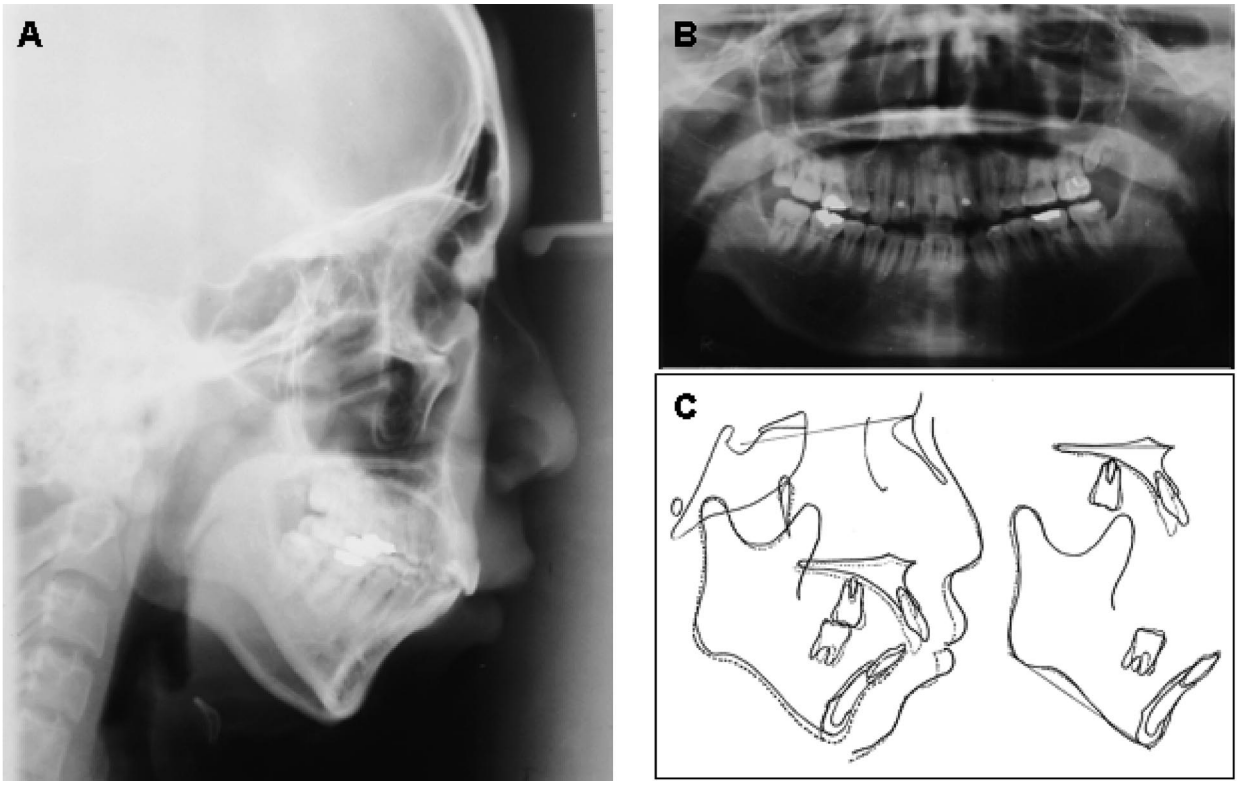

FIGURE 10. (A) Posttreatment cephalometric radiograph; (B) posttreatment panorama; and (C) superimpositions of lateral cephalograms: pretreatment (solid line) to posttreatment (dotted line).

TABLE 1. Cephalometric Survey[a]

	Average (Male)	Pretreatment	Posttreatment
SNA (°)	82	77	75
SNB (°)	80	69	68.5
ANB (°)	2	8	7.5
PFH/AFH (%)	95/136 (70%)	83/135 (61%)	84/139 (60%)
SN-OP (°)	15	25	27
FH-U1 (°)	116	117	100
FMA (°)	22	36	37.5
IMPA (°)	97	105	103.5
FMIA (°)	61	39	39
UL-E plane (mm)	−0.7	8	5
LL-E plane (mm)	0.5	10	6
Interincisal angle (°)	124	103	118
Mx 1 to NA (mm)	8	12	6
Mx 1 to NA (°)	26	32	17
Mn 1 to NB (mm)	8	15	14
Mn 1 to NB (°)	27	38	38
SN to PP (°)	9	9	9

[a] Supplement *Korea J Orthod.* 1997.

was very pleased with the final treatment result, even though the lips remained full compared with the cephalometric norm. An advancement genioplasty can be considered for better esthetic result.

Although the lower left lateral incisor and canine became mildly crowded, the treatment results were maintained six-month postretention (Figure 11).

In this case, we used a horseshoe appliance in the lower dentition as intermaxillary anchorage for retracting the maxillary anterior teeth en masse. We expected that the

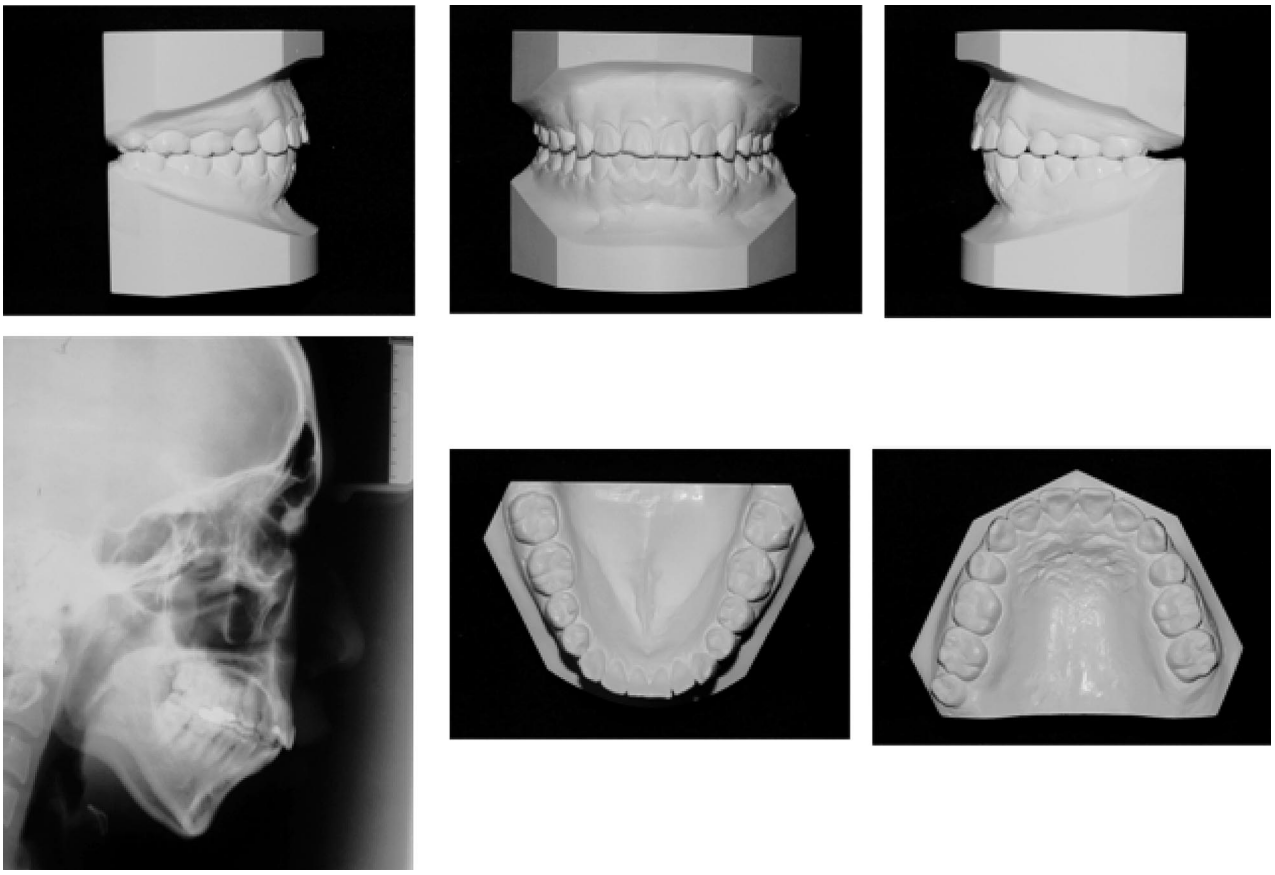

FIGURE 11. Six-month postretention study models and cephalometric radiograph.

horseshoe appliance would prevent tooth movement in the lower dentition during the healing period after the multiple odontoma was removed. The horseshoe appliance was specially designed as an intraoral removable appliance that would prevent extrusion and individual movement of the mixed dentition teeth during application of intermaxillary elastics.[15,16] It was made with resin, and the intraoral hooks for the elastics were attached bilaterally to the distobuccal surface of the permanent first molar.

The open bite closure was designed to occur by the maxillary teeth moving down in the treatment of this case. An advantage of the segmented approach used here is that the anterior teeth are free to move while the posterior teeth are stabilized. But the bracket heights between the anterior and posterior segments tend to get malaligned as the open bite is closed in the conventional segmental approach.[10] No bracket is bonded to the anterior portion during C-lingual retractor period. Therefore, there is no need for rebracketing or making compensating bends in the arch wire after the retraction period.

In spite of good treatment progress, we found that the upper second premolars were mesially tipped and intruded after en masse retraction in this case (Figure 7B). This was because of poor posterior segment stabilization. For a better anchorage control, it is indispensable to apply continuous low-magnitude forces on a rigid posterior segment. Additionally, it is necessary to tie the teeth in the posterior segment together using stiff wire.

CONCLUSIONS

The C-lingual retractor is a very esthetic and effective way to close the extraction space and to prevent unwanted tooth movement by the use of a single-point force application and by control of force magnitude and force direction. It gives the orthodontists the ability to retract the upper anterior dentition without patient compliance and to close the open bite by using force direction control and can be used in routine orthodontic patients.

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