Treatment of Adult Class II Deep-Bite Patients with Preadjusted Lingual Appliances and Intermaxillary Lingual Elastics

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The correction of a full-cusp Class II malocclusion is often challenging in adult patients, especially when it is accompanied by an underlying anteroposterior skeletal discrepancy. Although orthognathic surgery is the ideal solution in most cases, many patients are unwilling to undergo surgical treatment.^{1,2}

The complexity is further increased when the patient requests an "invisible" appliance. Intermaxillary Class II elastics on the lingual side, combined with a complete lingual appliance, provide excellent esthetics but are rarely sufficient to correct a full-cusp Class II relationship in a nongrowing patient if not supplemented by other mechanics.

Molar distalization represents a viable option in adult deep-bite nonextraction cases. Intraoral appliances have been found effective,³⁻⁵ but are associated with significant anterior anchorage loss.^{6,7} Miniscrew anchorage may offer the best solution^{8,9} because it eliminates roundtripping of the anterior teeth. The possibility of en-masse distalization using interradicular miniscrews has



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CEI TIALOMETRIO AMALISIS			
	Norm	Pretreatment	Post-Treatment
SNA	82.0° ± 3.5°	81.2°	79.2°
SNB	80.0° ± 3.5°	77.0°	75.4°
ANB	2.0° ± 2.5°	4.2°	3.8°
SN/ANS-PNS	8.0° ± 3.0°	7.9°	8.0°
SN/GoGn	33.0° ± 2.5°	24.0°	25.7°
ANS-PNS/GoGn	25.0° ± 6.0°	16.1°	17.7°
1-PP	110.0° ± 6.0°	89.8°	108.2°
1-GoGn	94.0° ± 7.0°	95.1°	104.7°
1-APg	2.0mm ± 2.0mm	5.0mm	3.5mm
Overjet	3.5mm ± 2.5mm	2.8mm	2.5mm
Overbite	2.0mm ± 2.5mm	5.3mm	1.6mm
Interincisal angle	132.0° ± 6.0°	159.0°	129.0°

TABLE 1CEPHALOMETRIC ANALYSIS

been proposed by Jeon and colleagues.¹⁰ This method has the advantage of reducing the molar tipping seen with single-tooth distalization, which often leads to relapse.¹¹ Moreover, no laboratory procedures are required.

The present article demonstrates how to treat an adult deep-bite patient with a full-cusp Class II relationship using en-masse maxillary distalization from a lingual preadjusted appliance, combined with interradicular palatal miniscrews and intermaxillary lingual elastics.

Case Report

A 35-year-old female patient presented with the request to have her teeth aligned by means of an esthetic appliance. She exhibited a short lower facial third, a slight mandibular symphysis deviation toward the left, and varying mandibular angle heights (Fig. 1). From a lateral view, the profile appeared flat, with a balanced nose, an excessive nasolabial angle, a marked labiomental sulcus, a retrusive mandibular position, and a prominent chin. The patient had bilateral fullcusp Class II canine and molar relationships and mild anterior crowding, with the upper right lateral incisor displaced buccally and the upper central incisors displaced lingually. The upper arch was slightly contracted, while the upper and lower curves of Wilson were accentuated. Negative torque of the buccal and posterior segments was evident in both arches, along with an anterior deep bite and an accentuated lower curve of Spee. The upper midline deviated toward the right, and the lower midline toward the left.

The patient's periodontal biotype was thick. The panoramic radiograph revealed the presence of all teeth except for the third molars. Cephalometric analysis (Table 1) indicated a skeletal Class II relationship (ANB = 4.2°) with the mandible in a retruded position (SNB = 77°). The skeletal pattern was severely hypodivergent (SN/MP = 24°), with a counterclockwise-oriented occlusal plane. The upper incisors appeared severely retroclined (90°), while the lower incisors were normally inclined (95°).

Fig. 2 Manual setup.





Fig. 3 A. .013" copper nickel titanium STb* Small wire inserted in mandibular arch. B. One month later, .013" copper nickel titanium STb Small wire inserted in maxillary arch, with occlusal build-ups on second molars and open-coil springs from central incisors to canines.





The patient rejected the recommendation of surgical-orthodontic treatment, which would have allowed bimaxillary advancement and posterior rotation of the maxillomandibular complex. A non-extraction treatment option that considered the patient's profile features and her lip position with respect to the Ricketts E-line was then presented and accepted.¹²

A preadjusted lingual technique¹³ was chosen because of the patient's request for an invisible appliance. The biomechanics would allow us to avoid proclination of the lower incisors during leveling and alignment, since the intrusive force would pass closer to the lower incisors' center of resistance.¹⁴

We first performed a manual setup for the



Fig. 4 Addition of closed-coil springs for spring reactivation after one month of treatment.

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STb Light Lingual System,* including torque overcorrections in the anterior, buccal, and posterior segments of both arches (Fig. 2). Brackets were bonded using single jigs, following the Komori system and the KommonBase philosophy.¹⁵

We began by bonding the lower arch and inserting an .013" STb Small copper nickel titanium archwire for initial alignment (Fig. 3A). One month later, the upper arch was bonded, and the same size STb archwire was placed (Fig. 3B). Occlusal buildups were added on the upper second molars to obtain tripodic contact during leveling and alignment. Open-coil springs were inserted between the upper right central incisor and canine and the upper left central incisor and canine to increase space for bonding brackets on the upper right lateral and left central incisors.

One month later, the open-coil springs were reactivated with the addition of two closed-coil springs (Fig. 4).

Three months after treatment began, brackets were bonded to the upper lateral incisors (Fig. 5). A closed elastomeric chain was inserted between the lower right central incisor and canine to facilitate their complete rotational correction.

Two months later, $.018" \times .018"$ copper nickel titanium STb Small archwires were inserted in both arches for leveling and torque control. We added .014" Kobayashi hooks at the upper canines for attachment of full-time $\frac{3}{16}$ ", 6oz Impala* Class II elastics (Fig. 6). An elastomeric chain was placed from the upper right to the upper left first premolar to prevent space opening.

Another two months later, interradicular miniscrews were inserted on the palatal side of the

upper first molars for maxillary anterior retraction using elastomeric chain to posted hooks soldered lingually between the upper lateral incisors and canines (Fig. 7). An .018" × .018" stainless steel posted STb wire was inserted in the upper arch, with the addition of root-palatal torque and an accentuated curve of Spee from the upper right to the upper left lateral incisor. At this point, .014" Kobayashi hooks were added at the upper first premolars for the attachment of full-time $\frac{3}{16}$ ", 6oz Impala Class II elastics. An elastomeric chain was placed to avoid space opening, this time from the upper right to the upper left lateral incisor.

After nine months of treatment, the upper left canine was rebonded, and an .018" × .018" copper nickel titanium STb Small wire was inserted in the upper arch, with .014" Kobayashi hooks added to the upper canines to facilitate nighttime wear of $\frac{3}{16}$ ", 6oz Impala Class II elastics (Fig. 8). An elastomeric chain was inserted from the right to the left interradicular miniscrew, passing through the anterior segment from the upper right to the upper left canine to continue en-masse retraction. At the same appointment, an .0175" × .0175" TMA* STb wire was inserted in the mandibular arch for leveling, with a slight reverse curve to obtain a complete flattening of the curve of Spee.

Another two months later, an .018" × .018" stainless steel posted STb wire was reinserted in the maxillary arch, with the addition of root-palatal torque and an accentuated curve of Spee from the upper right to the upper left lateral incisor, and .014" Kobayashi hooks were placed at the upper canines for attachment of full-time $\frac{3}{16}$ ", 6oz Impala Class II elastics (Fig. 9). An elastomeric chain



Fig. 5 After three months of treatment, brackets bonded to upper lateral incisors; closed elastomeric chain added between lower right central incisor and canine for rotational correction.



Fig. 7 After seven months of treatment, interradicular miniscrews inserted on palatal side of upper first molars for maxillary anterior retraction from posted hooks between lateral incisors and canines; .018" × .018" stainless steel posted STb wire inserted in upper arch, with Kobayashi hooks at upper first premolars and closed elastomeric chain from lateral incisor to lateral incisor.





Fig. 8 After nine months of treatment, upper left canine rebonded and .018" × .018" copper nickel titanium STb Small wire inserted in upper arch, with Kobayashi hooks at upper canines and closed elastomeric chain from right to left palatal miniscrew; .0175" × .0175" TMA* STb wire inserted in mandibular arch for leveling and alignment.



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Fig. 9 After 11 months of treatment, .018" × .018" stainless steel posted STb wire reinserted in maxillary arch, with Kobayashi hooks at upper canines and open elastomeric chain from first molar to first molar.



Fig. 10 After 14 months of treatment, Kobayashi hooks added at upper and lower right first premolars for attachment of intercuspation elastics.

was applied from the upper right to the upper left first molar.

Three months later, .014" Kobayashi hooks were added at the upper right and lower right premolars for nighttime wear of $\frac{3}{16}$ ", 6oz Impala intercuspation elastics on the right side (Fig. 10). Fulltime Class II elastics were continued on the left side.

After 17 months of treatment, finishing bends were added to correct rotations of the lower right central and lateral incisors, and a new elastomeric chain was placed from the upper right to the upper left first molar to maintain space closure. One week later, .1mm interproximal reduction was performed from the upper left central to lateral incisor and from the lower right central to lateral incisor to provide space for midline alignment with an elastomeric chain from the lower left to the lower right first premolar.

After 18 months of treatment, both arches were debonded and the palatal miniscrews were removed. Maxillary and mandibular Essix** retainers were delivered (with a slight step-in at the upper right lateral incisor to finalize its position).

A solid Class I canine and molar relationship





Fig. 12 Upper 2-2 and lower 3-3 fixed lingual retainers bonded one month after treatment.

was obtained on each side, while the crowding was resolved, the lower curve of Spee was flattened, and the deep bite was corrected (Fig. 11). The final panoramic radiograph showed root parallelism. Cephalometric analysis confirmed the improvement in facial and dental relationships (Table 1). Upper incisor torque was significantly increased (from 90° to 108°), and the lower incisors were proclined (from 95° to 105°). A significant posterior rotation of the occlusal plane (PP/OP from 7° to 14°) increased the upper incisor display in the patient's smile, while the profile was maintained. The Ricketts E-line¹² was unchanged, supporting the decision not to extract teeth.

One month after treatment, upper 2-2 and lower 3-3 fixed lingual retainers were bonded (Fig. 12), and new upper and lower Essix retainers were delivered. Treatment results were stable three months later (Fig. 13).

Discussion

Our patient's profile could have been improved by orthognathic surgery, but she declined that option. Therefore, the best possible camouflage treatment for dentoalveolar Class II correction was planned.

While lingual Class II elastics are efficient and esthetic when combined with a lingual appliance, they produce secondary effects such as rotation of the occlusal and mandibular planes and lower incisor proclination.¹⁶ Posterior rotation of the occlusal and mandibular planes were advantageous in this case, but a full-cusp Class II correction had to be achieved while minimizing proclination of the lower incisors. Anchorage from interradicular miniscrews was used in conjunction with the Class II elastics to facilitate enmasse maxillary distalization and produce a clockwise rotation of the occlusal plane, as noted in previous reports of distalization with miniscrew anchorage.^{17,18}

The use of rectangular stainless steel wires in an entire arch calls for high resistance and more bodily movement.¹¹ In this case, the upper arch could be distalized while leveling and alignment of the lower arch were carried out, thus reducing the overall treatment time to 18 months. The mandibular dentoalveolar advancement also limited the extent of maxillary distalization that was required.

Bechtold and colleagues found that a pair of interradicular miniscrews provided enough anchorage for efficient en-masse maxillary distalization to correct an end-to-end Class II malocclusion using a labial technique.¹⁹ For treatment of a fullcusp Class II malocclusion with a labial appliance, they recommended that the miniscrews be removed and reinserted during treatment to avoid contact and consequent damage to the root surfaces.^{17,20} The combination of palatal interradicular miniscrews and a lingual appliance provides more space for tooth movements,²¹ permitting full-cusp Class II correction with less risk of root-surface contact from the miniscrews. Even though the damage caused by titanium miniscrews is reversible,²² we advise that the insertion path be tilted apically and the miniscrew be positioned closer to the distal tooth to avoid root contact.10



Fig. 13 Patient three months after treatment.

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