CASE REPORT

Lingual Extraction Treatment of Anterior Open Bite in an Adult

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Treatment of patients with anterior open bites continues to be a subject of controversy in the orthodontic literature.[1-5] The first choice one has to make is between surgical and nonsurgical treatment, depending on whether the malocclusion is considered to be caused by dentoalveolar or skeletal discrepancies.[1,6] Such a distinction is not always clear-cut, since in most cases a combination of both etiologies exists.[7,8] In borderline cases, of course, most patients will prefer the nonsurgical alternative.[6]

Nonsurgical orthodontic treatment usually involves extractions to create dentoalveolar compensation for the skeletal discrepancy. Forward movement of the molars may allow the mandible to rotate upward and forward.[9,10] Retraction and lingual tipping lengthen the crowns of the anterior teeth, helping to close the bite. The limiting factor in this type of treatment is the amount of incisor exposure relative to the lips.[11]

The present article shows an adult anterior-open-bite patient who was treated nonsurgically with lingual appliances.

Diagnosis and Treatment Plan

A 24-year-old female presented with an anterior open bite and proclined upper and lower incisors on a Class III skeletal base (Fig. 1). Clinical examination revealed that the maxillary and mandibular midlines were shifted 4mm to the left compared to the facial midline, due to early extraction of the upper left first molar and asymmetrical crowding in the lower left anterior region. The patient had Class III dental relationships on both sides and mild crowding in both arches. The maxillary arch was constricted, with an edge-to-edge relationship on the right.

The profile was convex, the lower facial height was excessive, and the chin and lower lip were pronounced. The patient had incompetent lips and excessive exposure of the upper incisors both in repose and smiling. A forward tongue-thrust habit was diagnosed during swallowing and speech.

Cephalometric analysis showed a high mandibular plane angle (SN-MP = 40.5°) and an excessive lower facial height (LFH = 82mm), along with an overbite of –2mm and an overjet of 4mm (Table 1).

After the patient refused surgical-orthodontic treatment, an alternative orthodontic treatment plan was designed to correct the dentoalveolar malocclusion by retracting and elongating the upper anterior teeth while controlling the extrusion of the posterior teeth. This was to be achieved with full lingual appliances after the extraction of the upper right second bicuspid and

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Fig. 1 24-year-old female with anterior open bite before treatment.

both lower first bicuspids.

Although it was unclear whether the tongue thrust was a primary or secondary contributor to the anterior open bite, the patient was encouraged to practice positioning the tongue behind the upper lingual brackets during swallowing and speech. As a result, there was no need to use a tongue crib during or after treatment. The rationale was that after the establishment of a dentoskeletal morphologic configuration that does not require abnormal tongue activity for circumoral sealing, the tongue usually assumes normal position and function.

Treatment Progress

Lingual brackets with .018" slots from cuspid to cuspid and .022" slots for the posterior teeth were bonded indirectly using the SILAM jig.*[12] In bracket positioning, 10° extra

Fig. 2 Increase in open bite and overjet during torque establishment.

*SILAM Orthodontics Ltd., 19 Almog St., Ramat-Efal, Israel 52190.

Fig. 3 Patient after 15 months of treatment.

torque was added to the Roth prescription in the maxillary incisor and canine brackets.[13] The anterior torque was therefore 22° for the central incisor brackets, 18° for the lateral incisors, and 9° for the cuspids.

Initial leveling and alignment were accomplished with .016" Nitinol** archwires. Torque was established with an .0175" × .0175" TMA*** archwire. During this phase, the overjet and open bite increased by about 1mm (Fig. 2).

Space closure was performed on a flat .016" × .022" stainless steel archwire, using sliding mechanics and intramaxillary elastics. No intermaxillary elastics were used. Final detailing was carried out with an .0175" × .0175" TMA archwire.

**Trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016.

***Registered trademark of Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.

Appliances were removed after 15 months of active treatment. The patient showed increased lip competence and an improved appearance due to the reduction in incisor procumbency (Fig. 3). An upper Hawley retainer was prescribed for at least two years of nighttime wear (Fig. 4).

Treatment Results

A series of cephalometric

Fig. 4 Patient two years after treatment.

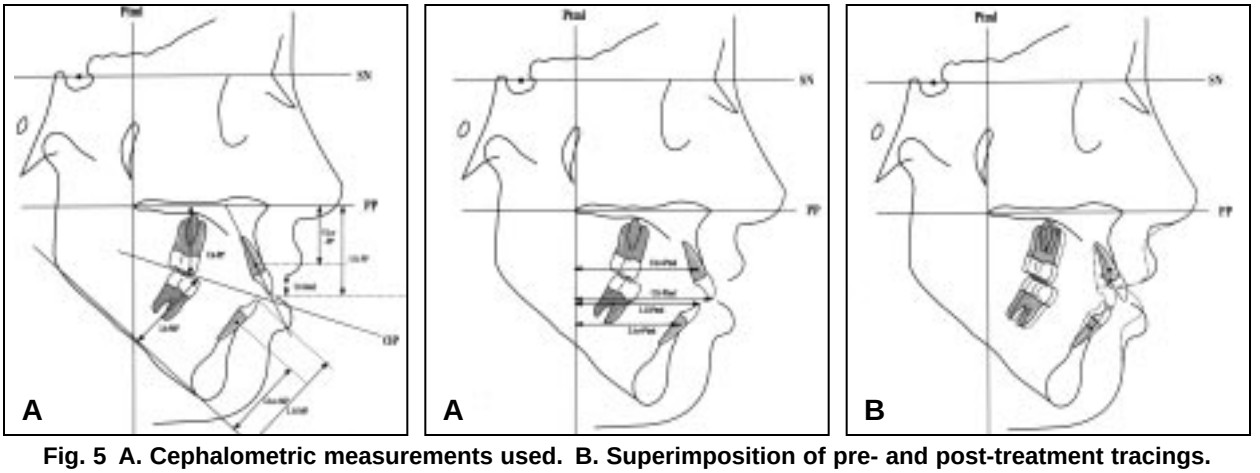

Fig. 5 A. Cephalometric measurements used. B. Superimposition of pre- and post-treatment tracings.

measurements was made to evaluate the results (Fig. 5A). A coordinate system was used, the *x*-axis being the palatal plane and the *y*-axis a perpendicular through the reference point pterygomaxillare, as described by Melsen and colleagues.[14] The center of resistance of the incisors was marked on the pretreatment radiograph according to the marginal bone level, as described by Burstone and Pryputniewicz.[15]

Superimposition of the pre- and post-treatment cephalograms showed that the anterior open bite was successfully closed (Fig. 5B). The increase in overbite from –2mm to 1mm can be attributed to a positive change in the distance between the center of resistance and the palatal plane (U1cr-PP difference = 3mm) and to lingual tipping of the upper incisors. The lower incisors did not contribute to the overbite correction, since their vertical position was almost unchanged.

Overjet decreased from 4mm to 2mm as a result of bodily retraction of the upper incisors (a decrease of 4mm in the distance from their centers of resistance to the pterygomaxillary line, U1cr-Ptml), together with lingual tipping (a decrease of 7mm in the distance from the upper central incisor edges to the pterygomaxillary line, U1i-Ptml).

The lower incisors' center of resistance was retracted by 4.5mm (L1cr-Ptml), and the incisal edges were retracted by 5mm (L1i-Ptml). Upper incisor exposure (U1-StoS) did not change, due to a slight reduction in the curl of the upper lip, which followed the retracted upper teeth.

TABLE 1
CEPHALOMETRIC DATA

	Pretreatment	Post-Treatment
Overbite	–2.0mm	1.0mm
U1i-PP	35.0mm	38.5mm
U1cr-PP	19.0mm	22.0mm
U1-PP	116.0°	106.0°
L1i-MP	44.0mm	43.5mm
L1cr-MP	29.5mm	29.5mm
OP-SN	20.0°	24.0°
Overjet	4.0mm	2.0mm
U1i-Ptml	57.0mm	50.0mm
U1cr-Ptml	49.5mm	45.5mm
L1i-Ptml	52.0mm	47.0mm
L1cr-Ptml	43.0mm	38.5mm
U6-PP	24.0mm	24.5mm
L6-MP	36.0mm	35.5mm
SN-MP	40.5°	41.0°
LFH	82.0mm	82.0mm
U1-StoS	8.5mm	8.5mm

Discussion

Vertical movement of the center of resistance occurs automatically with lingual appliances in the absence of intermaxillary elastics. The upper teeth tend to tip lingually during space closure because the retraction force is almost always lingual to the center of resistance of the anterior teeth, and a crown-lingual/root-labial rotation moment is thus produced. To avoid retroclination of the anterior teeth during space closure, the brackets are usually positioned with extra lingual root torque, as in this case. The added torque generates an extrusive force on the incisor crowns[16,17] and an intrusive force on the upper molars (Fig. 6).

In the present case, successful vertical control of the upper and lower molars is demonstrated by the insignificant change in the distances from the molar cusps to their respective planes of reference (U6-PP = .5mm, L6-MP = –.5mm). Since the molars were not extruded, the mandibular plane angle was virtually unaltered (SN-MP difference = .5°), and lower facial height was unchanged.

A vertical bowing effect in the bicuspid area is sometimes seen during space closure in lingual cases. To avoid this side effect, a curve of Spee is usually

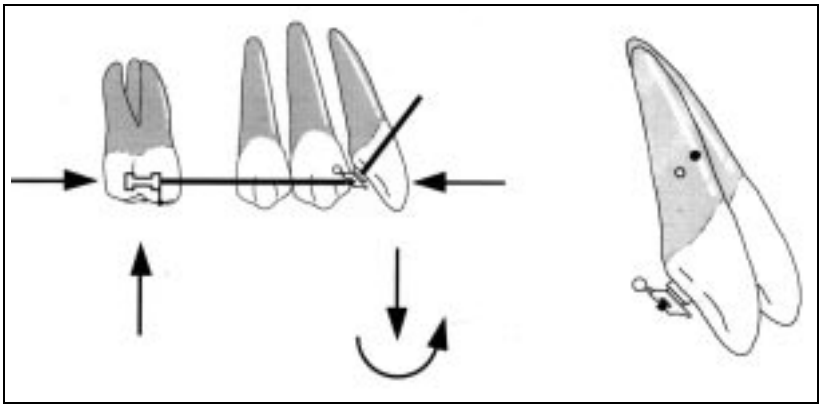

Fig. 6 Added torque generates extrusive force on incisors and intrusive force on molars.

added to the closing archwire. This may produce an intrusive force on the incisors, however, counteracting the extrusive force generated by the extra torque. Therefore, a flat archwire was used for space closure in the case shown here.

Conclusion

The factors that contributed to a successful result in this lingual extraction treatment of an adult anterior open bite were:

- An extrusive force on the incisors and an intrusive force on the molars, produced by extra torque in the anterior brackets. The use of a flat archwire for space closure, contrary to the usual curve of Spee in lingual extraction treatment, allowed full expression of the extrusive force on the incisors.
- An undersize wire in the slots of the posterior lingual brackets and the use of light forces, reducing friction and anchorage requirements and eliminating the need for intermaxillary elastics.
- A possible tongue-crib effect of the lingual brackets.

Limitations of this technique include:

- An unpredictable increase in the amount of exposure of the upper incisors relative to the upper lip.
- The possibility that the lingual brackets might exacerbate a forward tongue thrust if the patient did not receive or follow instructions for proper tongue positioning.
- Long-term stability, which needs to be evaluated in future studies.

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