Nonsurgical approach to Class 1 open-bite malocclusion with extrusion mechanics: A 3-year retention case report

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Anterior open bite is one of the most challenging malocclusions for orthodontic treatment. The high incidence of relapse is a major concern. Therefore, accurate initial examination, diagnosis, treatment plan, and consideration of habitual risk factors are crucial for a successful outcome without unwanted sequelae. Excellent patient compliance for retainer wear is also a critical factor. This case report shows the 3-year stability of a nonsurgical and nonextraction orthodontic treatment of a 5-mm anterior open-bite malocclusion in a 12-year-old girl with extrusion mechanics and habit modification. After 2 years of orthodontic treatment, excellent outcomes were achieved. With an appropriate retention protocol, the long-term stability of the treatment was favorable. (Am J Orthod Dentofacial Orthop 2015;147:499-508)

A nterior open bite is a condition characterized by a lack of vertical overlap between the incisal edges of the maxillary and mandibular teeth when the remaining teeth are in occlusion. 1,2 Anterior open bite has a multifactorial etiology including skeletal, dental, respiratory, neurologic, and habitual components. 3-6 Thumb sucking, tongue thrust, and increased vertical skeletal relationships are significant risk factors associated with anterior open bite, 5,6 and patients often have concomitant transverse discrepancies. 7 Various treatments with nonsurgical or surgical approaches including habit modification have been reported in the literature for open bite. 11,12 The long-term stability after surgical and nonsurgical approaches is thought to be acceptable, 3,13-15 but some reports showed the opposite. 7,17 It is one of the most challenging malocclusions to treat because of the high frequency of relapse. 3,18-22 Open bites relapse in 25% to 38% of orthodontically treated patients. 23 In this case report, we present the 3-year follow-up and the results of nonsurgical treatment of an adolescent patient with an anterior open bite and a constricted maxillary arch who was treated with rapid palatal expansion, habit modification, and extrusion mechanics.

DIAGNOSIS AND ETIOLOGY

A Hispanic girl, age 12 years 9 months, had a convex profile, a Class 1 malocclusion, an anterior open bite, and a tongue-thrust habit. She was in a good general health and had no history of major systemic disease or accident or history of a thumb-sucking habit. Her chief complaint was an open bite with crooked mandibular teeth. The tongue-thrust habit was observed during swallowing and conversation.

Pretreatment facial photographs (Fig 1) showed that the patient had a convex soft tissue profile with an obtuse nasolabial angle. From the frontal view, her face was slightly asymmetric, and the chin was deviated slightly toward the left. Upon smiling, she had inadequate gingival exposure. Intraoral and dental cast examinations (Figs 1 and 2) demonstrated a Class II molar tendency bilaterally. A 5-mm anterior open bite was observed with 2 levels of occlusal planes, anterior and posterior. The only teeth in contact were the left first molars and the right second premolars and first molars. A significant tongue-thrust habit was noticed at rest and also while swallowing. The maxillary arch was relatively narrow compared with the mandibular arch. Five millimeters of anterior crowding in the maxillary arch and 4 mm of anterior crowding in the mandibular arch

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were observed. A 3-mm Bolton discrepancy with mandibular anterior tooth excess was measured. No mandibular deviation or clicking noises were detected during opening or closing of her jaws.

Panoramic and lateral cephalometric radiographs were taken before treatment (Fig 3). The panoramic radiograph showed no caries, and all third molars were congenitally missing (Fig 3, A). The cephalometric analysis (Fig 3, B; Table) demonstrated a Class I skeletal relationship (ANB, 2.2°; Wits appraisal, −2.2 mm) with a hyperdivergent growth pattern tendency (SN-MP, 38.7°). The angle between the maxillary incisors and the sella-nasion plane was 107.4°, the mandibular incisor to mandibular plane angle was 99°, and the interincisal angle was 114.8°. Based on the findings, the patient was diagnosed as skeletal Class I with a dental open bite. The etiology of the open-bite malocclusion appeared to be a combination of hereditary and habitual factors.

**TREATMENT OBJECTIVES**

The following treatment objectives were established: (1) close the patient's open bite and create ideal overjet and overbite, (2) relieve the crowding, (3) correct the constricted maxilla, (4) eliminate the tongue thrust, (5) correct the midline deviation, (6) obtain a stable occlusal relationship, and (7) ultimately improve her dental esthetics by establishing an esthetic smile.

**TREATMENT ALTERNATIVES**

The patient had a hyperdivergent growth pattern tendency, and dental extrusion mechanics might create a more severe open bite without control of the vertical dimension. Orthognathic surgery to close her open bite by a segmented 3-piece LeFort I osteotomy with a bone graft, combined with fixed orthodontic treatment, was discussed with the patient and her parents. Skeletal
nonextraction approach with rapid palatal expansion. Hence, as soon as orthodontic treatment with expansion
begins, and in conjunction with the open-bite treatment for Hyper-Table: Cephalometric analysis.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Mean Initial Final (x var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower lip to bite (mm)</td>
<td>3.0 ± 2.0</td>
</tr>
<tr>
<td>Upper lip to bite (mm)</td>
<td>-2.2 ± 1.5</td>
</tr>
<tr>
<td>Lower incisors</td>
<td>0.6 ± 3.2</td>
</tr>
<tr>
<td>Upper incisors</td>
<td>1.4 ± 1.2</td>
</tr>
<tr>
<td>ANB</td>
<td>2.7 ± 3.2</td>
</tr>
<tr>
<td>SNA</td>
<td>7.4 ± 4.9</td>
</tr>
<tr>
<td>SNb</td>
<td>7.2 ± 3.2</td>
</tr>
<tr>
<td>Wits appraisal (mm)</td>
<td>2.2 ± 1.4</td>
</tr>
</tbody>
</table>

The patient and her parents desired orthognathic

postextraction growth.

that be possible with this surgical approach.

discrepancy correction, facial and dental esthetics.

FIG 2. Pretreatment dental models.
Fig 4. Medial diastema between the maxillary incisors after activation of the Haas rapid palatal expander.

Fig 5. Progress intraoral photographs at 9 months.

and a tongue appliance to correct the open-bite malocclusion.

**TREATMENT PROGRESS**

Before the treatment, the patient was referred to a pedodontist to verify that she had no caries and for a routine periodontal checkup. Bands were fitted on the maxillary first premolars and first molars, and an impression was taken for a Haas rapid palatal expander. The Haas expander with a 12-mm expansion screw was cemented in the maxillary arch, and the parents and the patient were instructed to turn the screw once each day until a buccal overjet was observed. Then the expander was stabilized for 4 months. A 3-mm diastema between the maxillary central incisors was observed at the end of expander activation (Fig 4). Preadjusted
0.018 × 0.025-in slot edgewise brackets (3M Unitek, Monrovia, Calif) were bonded to each tooth, and a 0.016-in archwire and a 0.016 × 0.022-in superelastic nickel-titanium archwire (Dentsply GAC, Bohemia, NY) were used for the initial leveling. At the same time, a supplemental 0.016 × 0.022-in stainless steel archwire (Dentsply GAC) was fabricated as an extrusion arch using the Haas expander as anchorage and ligated to the nickel-titanium base wire at the midline during the leveling stage (Fig 5). Two 0.030-in stainless steel wires were fabricated as tongue spurs and bonded on the mandibular central incisors with composite resin to modify the patient's tongue-thrust habit (Fig 6). After removal of the Haas expander, a transpalatal arch was cemented to maintain the transverse dimension of her maxilla (Fig 6). Class II triangle elastics (1/4 in, 4.5 oz) from the maxillary canines to the mandibular canines and first molars, and box-vertical elastics (1/4 in, 4.5 oz) from the maxillary lateral incisors to the mandibular lateral incisors were applied during the entire orthodontic treatment. During the finishing stage, final detailing of the occlusion was accomplished with 0.017 × 0.025-in titanium-molybdenum archwires (Dentsply GAC) in conjunction with vertical elastics with Class II vectors (1/4 in, 6 oz). While the orthodontic treatment was in progress, the patient learned new tongue positions at rest and during swallowing. Her compliance was excellent throughout the treatment. One and a half millimeters of interproximal reduction was performed on the mandibular anterior teeth to eliminate the Bolton discrepancy.

A fixed retainer was attached to the lingual surface of the mandibular anterior teeth. Overlaid Hawley retainers were fabricated and delivered to secure the stability of both arches. A tongue crib was incorporated in the maxillary Hawley retainer to prevent relapse of the tongue-thrust habit. Total treatment time for this patient was 24 months.
**TREATMENT RESULTS**

The posttreatment records showed that the treatment objectives were achieved. The facial photographs showed improved profile esthetics (Fig 7). The open bite, which was the patient’s chief complaint, was eliminated, and acceptable overbite and overjet were achieved. The midline deviation was corrected, and the dental midlines were aligned with the facial midline. The posterior crossbites were eliminated, and the posterior occlusal relationships were improved with proper buccal overjet. Class I canine and molar relationships were established (Figs 7 and 8). The posttreatment panoramic radiograph showed proper space and root parallelism with no significant signs of bone or root resorption (Fig 9). Posttreatment lateral cephalometric analysis and superimposition showed skeletal changes with forward movement of the maxilla and mandible (ANB, 2.9°; Wits appraisal, -2.5 mm). The mandible rotated downward and backward, and there was a 1° increase in the mandibular plane angle (SN-MP, 39.7°). Significant extrusion of the maxillary and mandibular incisors was observed with a slight retroclination of the maxillary incisors (U1-SN, 102.1°) compared with the pretreatment angle and maintained angulation of mandibular incisors (L1-MP, 99.3°), and the interincisal angle was 118.8° (Fig 9; Table). The soft tissue facial profile was improved on the position of the lower lip, and her smile line was improved because of the extrusion of the maxillary anterior teeth (Figs 3, 7, and 10).

With her excellent compliance of retainer wear, at the 3-year retention visit, posttreatment stability was excellent. Gingival recession of 1.5 mm was found only on her maxillary right first premolar and not on any other teeth, and there was no periodontal pocket formation or dentin hypersensitivity. The alignment of the maxillary and mandibular teeth was stable. There were no changes in overbite, overjet, and posterior buccal overjet. The 3-year retention lateral cephalometric analysis and superimposition showed no
skeletal change after posttreatment (ANB, 2.9°; Wits appraisal, -3.1 mm) with the same mandibular plane angle (SN-MP, 39.6°). A slight proclination of the mandibular incisors (LI-MP, 100.1°) and a small nasal soft tissue change were detected (Figs 10-12; Table).

**DISCUSSION**

To achieve a stable result for the treatment of open bite, a combination of fixed orthodontic treatment, orthognathic surgery, and habit modification is often implemented. This case report showed favorable 3-year posttreatment stability of a nonsurgical approach for an open-bite malocclusion. In a nonsurgical and nonextraction approach, it is essential to prevent unwanted side effects—extrusion of the posterior teeth during extrusion of the anterior teeth—while pursuing benefits to the patient: increased anterior gingival display and prevention of sensation loss after surgery or extraction of teeth.

Another important consideration for patients with open-bite malocclusion is the role of habits (tongue thrust, thumb sucking, and nail biting). Many of these habits can cause relapse after orthodontic treatment. It is important to advise the patient of the possibility of relapse after active treatment even if the patient practices strict retainer wearing. Proper diagnosis, treatment planning, and retention are critical to achieve the most stable and favorable outcomes for patients with open-bite malocclusion. In our patient, the pretreatment, posttreatment, and retention cephalometric superimpositions showed that the maxillary and mandibular incisors extruded considerably, whereas the posterior teeth showed no significant extrusion.
An open-bite malocclusion is challenging to treat because of the high frequency of relapse. The long-term stability is a major concern when the treatment approach needs to be determined. Greenlee et al reported reasonable stability of both surgical (82%) and nonsurgical (75%) treatments of open bite measured by a positive overbite at 12 or more months after treatment. Several studies showed favorable outcomes and indicated that open-bite extraction treatment has greater stability of the overbite than open-bite nonextraction treatment. However, other authors believe that treatments involving extractions limit the tongue space and create instability after treatment. The favorable long-term stability of the nonsurgical and nonextraction approach in this study demonstrated that this approach could be a treatment approach of choice if the crowding is not severe and a skeletal change is not a treatment objective; however, habit modification and a strict retention protocol with excellent patient compliance are needed.

The gingival recession on the maxillary right first premolar detected at the 3-year follow-up visit may have resulted from the use of the Haas rapid palatal expansion to correct the posterior transverse deficiency. It has been reported that rapid palatal expansion may reduce buccal bone thickness by 0.6 to 0.9 mm and induce bone dehiscences on the anchorage tooth’s buccal aspect. The tooth-borne expander produced greater reduction of the first premolar buccal alveolar bone crest level than did the tooth-tissue borne expander. In this patient, we used a Haas expander, which is a tooth-tissue borne expander. Although mild gingival recession developed during the retention period, no pocket formation was detected on her maxillary right first premolar at the 3-year retention visit. In the future, transplantal distraction osteogenesis or implant-retained bone-borne rapid palatal expansion may reduce periodontal complications such as bone dehiscence and gingival recession.

CONCLUSIONS
This case report demonstrates that long-term stability with a nonsurgical approach to treat a Class I open-bite malocclusion with extrusion mechanics can be achieved after an accurate initial examination and diagnosis, and after eliminating any habitual risk factors. Excellent patient compliance for retainer wear is also a critical factor.
Fig 11. Three-year retention facial and intraoral photographs.

Fig 12. Three-year retention dental models.
REFERENCES