Orthodontic management of high Angle Class II Division 1 malocclusion with traumatic bite: A case report

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The orthodontic treatment of a young adolescent female with a high Angle Class II Division 1 malocclusion is presented. Successful treatment required a careful diagnosis, specific planning, and efficient biomechanical control of the force systems to correct the disharmony in the vertical and horizontal dimensions. En masse retraction of the six maxillary anterior teeth was done via a Kalra simultaneous intrusion and retraction archwire. Precise mechanics with excellent vertical control made it possible to successfully correct the malocclusion without undesirable sequelae. ORTHODONTICS (CHIC) 2012;13:e116–e126.

Key words: en masse retraction, high Angle, second premolar extraction

Vertical dysplasia presents a unique problem for orthodontists to diagnose and treat effectively. Several techniques such as high-pull headgear,1,2 maxillary splints with headgear,3 interocclusal bite blocks,4 active vertical correctors,5 modified transpalatal arches,6 and vertical holding appliances7 have been advocated to control vertical dimension in growing patients. In hyperdivergent patients, some clinicians recommend extraction to control the vertical dimension because extractions have been associated with closure of the mandibular plane angle.8,9 This article describes the simultaneous intrusion and retraction of six maxillary anterior teeth in a high Angle Class II Division 1 case.

CASE REPORT

Diagnosis and treatment plan
A 13-year-old girl reported with procumbent maxillary anterior teeth. Initial examination revealed a convex profile and incompetent lips with increased maxillary incisor exposure at rest (Fig 1). Dentally, she had a half-unit Class II buccal segment relationship with an overjet of 10 mm and a traumatic bite (Fig 2). The mandibular incisors were mildly crowded, and the mandibular right first premolar was buccally placed. Her oral hygiene was average, and the gingiva of the mandibular complex was inflamed. The malocclusion was presumed to be partially a result of a mouth-breathing habit with an underlying skeletal,
dental, and soft tissue problem. Therefore, initially, the patient was sent to an ear, nose, and throat physician for a medical consultation. There was no finding of any physical internal obstruction of the nasal air pathway that might have been the prime cause for the mouth-breathing habit.

Cephalometric analysis (Table 1 and Fig 3) revealed a tendency toward a mild vertical growth pattern and a Class II sagittal relationship, mainly due to mandibular retrusion. Treatment goals were to improve soft tissue balance and correct dental relationships. The maxillary first premolars were extracted primarily to correct overjet, and the mandibular second premolars were extracted to resolve mild crowding and facilitate a Class I molar relationship.
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Fig 2  Pretreatment casts.

Table 1  Cephalometric data

<table>
<thead>
<tr>
<th>Variables</th>
<th>Norm</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (degrees)</td>
<td>82 ± 3</td>
<td>79</td>
<td>76</td>
</tr>
<tr>
<td>SNB (degrees)</td>
<td>79 ± 3</td>
<td>74</td>
<td>73</td>
</tr>
<tr>
<td>SND (degrees)</td>
<td>76 ± 2</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>ANB (degrees)</td>
<td>3 ± 1</td>
<td>+5</td>
<td>+3</td>
</tr>
<tr>
<td>Wits appraisal (mm)</td>
<td>0</td>
<td>+5</td>
<td>+2</td>
</tr>
<tr>
<td>App-Bpp (mm)</td>
<td>5 ± 2</td>
<td>+13</td>
<td>+7</td>
</tr>
<tr>
<td>N-Pog (McNamara) (mm)</td>
<td>0 to –4</td>
<td>−15</td>
<td>−14</td>
</tr>
<tr>
<td>Maxillary incisor to maxillary plane angle (degrees)</td>
<td>108 ± 5</td>
<td>124</td>
<td>114</td>
</tr>
<tr>
<td>Mandibular incisor to mandibular plane angle (degrees)</td>
<td>92 ± 5</td>
<td>92</td>
<td>90</td>
</tr>
<tr>
<td>Interincisal angle (degrees)</td>
<td>133 ± 10</td>
<td>113</td>
<td>127</td>
</tr>
<tr>
<td>Maxillary mandibular planes angle (basal plane angle) (degrees)</td>
<td>27 ± 5</td>
<td>33</td>
<td>31</td>
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<tr>
<td>Upper anterior face height (mm)</td>
<td>52</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Lower anterior face height (mm)</td>
<td>72</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Face height ratio (%)</td>
<td>55 ± 2</td>
<td>58</td>
<td>58.4</td>
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<tr>
<td>Sn-Go-Gn (degrees)</td>
<td>32</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Lower incisor to A-Po line</td>
<td>0 to 2</td>
<td>+2</td>
<td>+1</td>
</tr>
<tr>
<td>Lower lip to Ricketts E plane</td>
<td>−2</td>
<td>+3</td>
<td>−0.5</td>
</tr>
<tr>
<td>Upper lip to Ricketts E plane</td>
<td>−2 to −3</td>
<td>+1</td>
<td>−2.5</td>
</tr>
</tbody>
</table>
Treatment progress

Treatment was initiated with the placement of a 0.022 × 0.028-inch standard edgewise appliance. A custom-made transpalatal arch with an acrylic resin button (Fig 4) was placed 4 mm from the palatal mucosa.

After extractions and preliminary alignment in the maxillary arch, nearly 4 months into treatment, a Kalra simultaneous intrusion and retraction (K-SIR) archwire (0.019 × 0.025-inch beta-titanium alloy [TMA]; Ormco) was fabricated with closed 7 × 2-mm U-loops at the extraction sites. In the neutral position, the U-loop was about 3.5 mm wide (Fig 5). The archwire was activated about 3 mm so that the mesial and distal legs of the loops were barely apart (Fig 6). A 0.019 × 0.025-inch stainless steel stabilizing wire was inserted in the second premolar and first molar region on both sides. The patient was advised to wear high-pull headgear with a facebow for 12 hours a day during space closure to augment molar anchorage.
Simultaneously, after alignment and leveling in the mandibular arch, a 0.019 × 0.025-inch stainless steel wire was fabricated with adequate lingual root torque incorporated in the incisor region. Hooks were soldered at the apex of the V-bend (between the canine and lateral incisor) on a 0.019 × 0.025-inch stainless steel wire. A closed coil spring (Ortho Organizers) stretched three times its original length (150 g of force) was used to mesialize the mandibular first molars on both sides (Fig 7).

A 0.019 × 0.025-inch stainless wire was reduced to 0.018 × 0.025-inch distal to first premolars to mesial of the first molars to facilitate sliding me-
chanics while maintaining integrity of the arch form. While the mesialization in the mandibular arch was being carried out, the maxillary teeth were being retracted and intruded (Fig 8). The K-SIR archwire was reactivated at this point. Mesialization of the mandibular first molars continued for 6 months, until a Class I buccal segment relationship was established (Fig 9). The mandibular arch was consolidated in a single anchorage unit by tying it together with stainless steel ligature wire (0.010-inch) in a figure-eight configuration. After 11 months of treatment, a T-loop (0.017 × 0.025-inch TMA wire; Ormco) with preactivation bends as desired was inserted into the auxiliary tube of the
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Fig 9  Class I molar relation achieved and wire being protruded distal to the first molars after mesialization.

Fig 10  T-loop ligated for second molar mesialization.

Fig 11  (a) Mesialized second molars; (b) Arch to maintain intrusion.

first molars and bondable buccal tube on the mandibular second molars (Fig 10). It took another 4 months to mesialize the second molars (Fig 11a). The T-loop was left in place for some time for root uprighting.

After space closure in the maxillary arch, the transpalatal arch was removed, a 0.018-inch Ni-Ti wire was ligated for alignment, and an intrusion arch (0.017 × 0.025-inch TMA wire; Ormco) was ligated to the main archwire to maintain intrusion of the anterior teeth (Fig 11b). Finally, a 0.019 × 0.025-inch stainless steel coordinated maxillary and mandibular archwire were fabricated and ligated in both arches. When proper angulation and inclination of the incisors was achieved and a good Class I molar and canine relationship was established, the occlusion was settled on lighter wire with up-and-down elastics for 2 weeks. Overall, treatment duration was 18 months.
Treatment results
Posttreatment records showed good functional and esthetic results (Figs 12 and 13). Treatment objectives were attained through good mechanical control of the dentition. Significant retraction and a good amount of intrusion of the maxillary incisors was accomplished, as demonstrated by the pre- and posttreatment superimposition of the head plates (Fig 14), thus improving the overjet and overbite relationship. The interlabial gap was reduced from 8 to 0 mm, with normal incisor show. Well-interdigitated Class I canine and first molar relationship were obtained, enhancing the stability of the buccal occlusion (see Fig 13). A posttreatment panoramic radiograph showed good paralleling of the roots (Fig 15).

Cephalometrically, the ANB angle was reduced by 3 degrees on account of the bodily retraction of the maxillary incisors (see Table 1). The basal plane angle closed 2 degrees, indicating good vertical control, and the maxillary incisors relative to the palatal plane were retracted 10 mm. The mandibular incisors were kept upright (90 degrees), thus improving facial balance. In addition, both the upper and lower lip procumbency were reduced by 3.5 mm, thus establishing the lip seal.

Fig 12  Posttreatment photographs.
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Fig 13 Posttreatment casts.

Fig 14 Pretreatment radiographs and tracings.
DISCUSSION

A custom-made transpalatal arch with an acrylic resin button was placed 4 mm from the palatal mucosa and used for vertical and transverse control. Wise et al\textsuperscript{11} speculated that a transpalatal arch left significantly off the palate with an acrylic resin button may prove to be more effective in controlling maxillary molar eruption. In particular, the vertical control that prevents molar extrusion and encourages molar intrusion is said to be produced by the tongue during deglutition and mastication.\textsuperscript{12,13}

Though being a maximum anchorage case with a tendency toward mild vertical growth pattern, separate canine retraction followed by incisal retraction would have been a likely treatment approach, but in this particular case, it was decided to retract the six anterior teeth collectively using a K-SIR archwire.\textsuperscript{10} The rationale for separate retraction in the edgewise technique is to conserve anchorage. However, Burstone\textsuperscript{14} and Nanda and Kuhlberg\textsuperscript{15} have demonstrated molar anchorage control using nonfrictional loop mechanics for en masse retraction.

A major advantage of the K-SIR appliance over archwires that provide similar mechanics\textsuperscript{14,15} is its simplicity of design with a minimal amount of wire in the loop configuration. The K-SIR archwire exerts about 125 g of intrusive force on the anterior segment, and a similar amount of extrusive force is distributed between the two buccal segments. High-pull headgear was worn for 12 hours per day during space closure (8 months), which helped to control anchorage in the anteroposterior direction and simultaneously provided vertical control. Though the maxillary second molars were banded and passively made a figure eight to enhance anchorage, they were not included in the sectional wire so as to prevent their extrusion.
Second premolar extraction\textsuperscript{16,17} was done in the mandibular arch primarily for three reasons: (1) only minimum incisor retraction was required, (2) correction of the buccal segment relationship, and (3) mesial movement of molars would have reduced the wedge effect and decreased facial vertical dimension. Since the case demanded correction of the protruded maxillary incisors and an improvement in profile, the anchorage requirement in the maxillary arch was maximum. Therefore, extraction of the maxillary second premolars was not considered. Lingual root torque was placed in the incisal section of the mandibular archwire since it was desirable both for esthetics and anchorage control. If the face is to have balance, the mandibular incisors must be overly upright to compensate for high Frankfort mandibular plane angle. The matter of obtaining lip competence has been crucial to the success of the case, which in turn will increase the functional efficacy as well as promote nasal breathing.

**CONCLUSION**

Regardless of the etiology of the increased vertical dimension, patients with this type of growth pattern may be more susceptible to dental extrusion and further bite opening during orthodontic treatment. The forces used must control vertical extrusion. Likewise, the maxillary anterior teeth should be intruded with sufficient definition since they are retracted to eliminate the gingival display. Although surgery or mini-implants could have easily corrected this malocclusion, the present case was treated successfully with a simple conventional approach. The treatment plan was simple and ensured a stable and esthetic result for the patient. Favorable skeletal growth, as well as the patient's cooperation, contributed to functional and esthetic improvement.

**REFERENCES**