Bimaxillary Protrusion Treated with Miniscrews

**SUMMARY**

This report describes a conservative orthodontic treatment of a bimaxillary protrusion adult case. After four first premolars extraction, two bone screws were laced in the infrrazygomatic crests to ensure maximal retraction and two additional bone screws were placed in between the central and lateral incisors for the vertical control of the maxillary anterior segment. Pleasing esthetic and functional results were achieved. (IJOI 2014;34:78-89)

Key word: Bimaxillary protrusion, miniscrew

**History and Etiology**

A 31-year-4-month-old woman presented with the major concerns of protrusive lips, mildly crowded teeth, and excessive gingival exposure ("gummy smile") (Figs. 1-2). The patient's medical and dental histories were non-contributory. Moreover, there was no evidence of contributing oral habits or temporomandibular dysfunction. The patient was treated to an acceptable result as (Figs. 4-9), as will be subsequently discussed.

**Diagnosis**

Pretreatment facial photographs showed a convex profile with protrusive lips and a gummy smile (Fig. 1). The pretreatment intraoral photographs and study models (casts) revealed a Class I molar relationship on both sides (Figs. 2-3). The maxillary midline was deviated 1 mm to the right of the facial midline. The cast evaluation (Fig. 3) documented the following dental problems: 1. anterior cross-bite (#24-26), 2. mild crowding of the upper and lower anterior segments.

The ABO Discrepancy Index (DI) was 18 as shown in the subsequent worksheet.†
Bimaxillary Protrusion Treated with Miniscrews

Skeletal:
- Skeletal Class II (SNA 81°, SNB 76°, ANB 5°), high mandibular plane angle (SN-MP 40°)

Dental:
- Class I canine and molar relationship
- Anterior cross-bite #24-26
- Crowding: moderate in the maxillary and mild in the mandibular anterior segments

Facial:
- Convex profile
- Bimaxillary protrusion with lip strain and excessive gingival exposure (“gummy smile”)
- Maxillary dental midline shifted 1 mm to the right of the facial midline

Treatment Objectives
The principal objectives were to: 1. intrude the maxillary dentition, 2. retract the maxillary and mandibular anterior segments, 3. retract the lips, and 4. achieve an ideal overjet and overbite relationship.

Maxilla (all three planes):
- A - P: Maintain
- Vertical: Maintain
- Transverse: Maintain
Fig. 7: Pre-treatment panoramic and cephalometric radiographs

Fig. 8: Post-treatment panoramic and cephalometric radiographs

Fig. 9:
Superimposed cephalometric tracings reveal retraction of the incisors, slightly increased vertical dimension of occlusion, and reduction of lip protrusion.
Bimaxillary Protrusion Treated with Miniscrews  IJOI 34

Treatment Alternatives

Because of the convex profile and protrusive lips, an orthognathic surgical option was discussed, but the patient deemed it to be too aggressive. Therefore, a more conservative plan was devised to meet the patient’s needs: 1. extract all four first premolars, 2. place bone screws in the infrrazygomatic crests bilaterally to ensure maximal retraction of the maxillary anterior segment, 3. use bone screws between the roots of the maxillary central and lateral incisors to control the vertical dimension of the upper incisors.

Appliances and Treatment Progress

Extraction of the four first premolars was accomplished before orthodontic treatment commenced. Brackets (.022” Damon Q®, Ormco) were used (Maxillary: high torque; Mandibular: standard torque). Both arches were bonded and aligned with the following arch wire sequence: .014” CuNiTi, .014”x.025”NiTi, .017”x.025” TMA, .019”x.025” SS. During the course of treatment, Class II elastics were upgraded from 3.5 to 4.5 oz. Two months after the .014”x.025” CuNiTi wires were placed, a panoramic radiograph revealed axial inclination problems, and brackets were repositioned accordingly. Extraction spaces were closed with power chains on a .019”x.025” SS archwire.

In the 20th month, two bone screws (OrthoBoneScrews®, Newton’s A) were placed bilaterally in the infrrazygomatic crests, and two additional Orthobonescrews (OBS) were placed bilaterally between the central and lateral incisors roots. These four bone screws acted as anchorage to reduce...
the gummy smile, by retracting and controlling the extrusion of the maxillary arch (Figs. 10-12). After twenty-seven months of active treatment, the appliances were removed and retainers were delivered.

Results Achieved
Maxilla (all three planes):
• A - P: Maintained
• Vertical: Maintained
• Transverse: Maintained

Mandible (all three planes):
• A - P: Retracted
• Vertical: Increased ~1-2mm
  (posterior rotation of the mandible)
• Transverse: Maintained

Maxillary Dentition
• A - P: Anterior segment retracted
• Vertical: Maintained
• Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition
• A - P: Incisors were retracted
• Vertical: Molars were extruded ~1mm
• Inter-molar / Inter-canine Width: Maintained

Facial Esthetics:
• Upper and lower lip protrusion was reduced, and lip competence was achieved

Retention
The fixed retainer was bonded on all maxillary incisors, and from canine to canine in the mandibular arch. An upper clear overlay was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. Instructions were provided for home hygiene and for maintenance of the retainers.

Final Evaluation of treatment
Cephalometric analysis (table) and superimpositions (Fig. 9) show that the lower molars were extruded ~1mm and the mandible was rotated posteriorly,
resulting in a slight increase in the mandibular plane angle and reduction of SNB. The upper incisor to SN angle decreased from 103° to 95°. The angle of the lower incisor to the Md plane decreased from 103° to 95°. Both lips were retracted and lip competence was achieved. The gummy smile was improved due to the retraction of the maxillary incisors and upper lip.

The ABO Cast-Radiograph Evaluation score was 16 points.1 There are some discrepancies in occlusal contacts, but the overall alignment was good. The protrusive lips were corrected and facial harmony was improved. The patient was particularly pleased with the improvement in her facial profile.

Discussion

Bimaxillary protrusion is a condition associated with proclined incisors (increased axial inclination) and protrusive lips.2 Because of the negative perception, relative to a protrusive dentition and lips in most cultures, many patients with bimaxillary protrusion seek orthodontic care to resolve the problem.

Bimaxillary protrusion can be treated effectively in growing patients and in adults with conventional orthodontic therapy. For many adult patients, orthognathic surgery is necessary to achieve an optimal esthetic result.3 However, some patients are resistant to orthognathic surgery due to expense, postoperative morbidity and the potential for complications. Despite the potential esthetic benefits associated with surgery, many patients opt for conventional orthodontics therapy.

Orthodontics treatment to correct bimaxillary protrusion usually involves extraction of four first premolars and the utilization of maximal anchorage to retract the anterior segments of both arches. Retracting the maxillary anterior segment may result in extrusion of the incisors and exacerbation of the gummy smile. To provide vertical control of the anterior segment, bone screws are used between the roots of the maxillary central and lateral incisors (Fig. 13). Currently, bone screws as temporary anchorage devices (TADs) provide increased anchorage and thereby expand the potential for orthodontic tooth movement.4 Premolar extractions are necessary to achieve maximal retraction with interradicular TADs. However, when bone screws placed in an extra-alveolar site such as the infrazygomatic crest (Fig. 14), the anterior segments can be retracted effectively without resorting to extractions in some cases. For the present patient premolar extractions were necessary because there was inadequate retromolar space to sufficiently retract both arches (Fig. 1S).
When using extra-alveolar TADs, the retraction of the arches is only limited by anatomic restraint. The space between the terminal molar and the external oblique ridge of the ascending ramus of the mandible, or the tuberosity in the maxilla, limits the distance that the entire arch can be retracted (Fig. 15).

There are some side effects associated with retracting the entire upper arch with posterior extra-alveolar TADs because the line of force is typically occlusal to the center of resistance (CR) of the maxilla, which causes the entire arch to rotate clockwise around the CR (Fig. 14). This effect results in downward movement (extrusion) of the anterior teeth and additional gingival exposure when smiling, which is unacceptable for patients being treated to correct a gummy smile. Additional undesirable side effects are lingual tipping of the anterior teeth, as well as dehiscence and fenestration of the labial plate of bone. An effective solution for the side effects due to retraction of the arch, via direct anchorage from posterior extra-alveolar TADs, is to place bone screws bilaterally between the central and lateral incisors roots (Figs. 13 and 16). Vertical traction, from
these interradicular TADs to the archwire, creates a moment in the opposite direction, producing counter-clockwise rotation of the maxillary arch. The correction of the gummy smile is achieved by intrusion of the anterior maxillary segment, in addition to preventing the clockwise rotation of the arch due to traction from the posterior TADs. Thus, four TADs, two in the infrrazygomatic crests and two in the anterior maxilla, effectively intrude all maxillary teeth, thereby correcting the gummy smile due to the inferiorly positioned maxillary dentition.

High-torque brackets were used on the maxillary incisors to compensate for the loss of torque during retraction of the maxillary arch. Employing high-torque brackets (Fig. 17) introduces torque correction gradually as the size of the rectangular archwire increases, thereby avoiding roundtrip tooth movement to correct excessively tipped incisors.⁵

There are other alternatives for correcting the torque of the anterior teeth, such as pre-torqued archwires, and root torquing auxiliaries (The ART® Auxiliary, Atlanta Orthodontics). When the ART® auxiliary wire is hooked on the main archwire, the roots of the anterior teeth are effectively torqued in a lingual (palatal) direction (Fig. 18).

Light force should be used during intrusion to minimize the root resorption. According to Burstone,⁶ 20 g of force is recommended for the intrusion of anterior teeth. As observed in Fig.13, the maxillary incisors were successfully intruded using OBS anchorage, and no significant root resorption was apparent (Figs. 7-8).

The soft tissue profile of the face does not always reflect changes in the under-lying skeletal structure during orthodontic treatment.⁷ The lip profile change is also influenced by lip thickness, posture and strain.⁸

For the present patient, cephalometric analysis (Cephalometric Summary Table) documents the substantial reduction in lip protrusion. The U1 to NA distance reduced from 6 to 0 mm while the E-line
to UL was decreased from 2 to 0 mm. The L1 to NB distance was reduced from 14 to 8 mm while the E-line to LL was decreased from 5.0-4.5 mm. These morphologic changes resulted in a lip profile that was much improved after treatment.

It is important to note that the present patient presented with an anterior cross bite that was associated with abnormal enamel abrasion of the incisors which compromises esthetics and occlusion (Fig. 15). After orthodontic treatment, the anterior cross bite was corrected, thereby preventing further anterior teeth mobility, potential for fracture, periodontal problems, and temporomandibular joint dysfunction. A mutually protected occlusion was achieved by establishing ideal overjet, overbite and canine guidance.

Conclusion

Bimaxillary protrusion is common in the Asian population. Conventional orthodontics treatment involves extraction of all four first premolars, followed by retraction of the anterior segments to reduce dental and soft tissue protrusion. Torque control of the incisors is an important issue. With the aid of four OBSs, the whole maxillary arch can be retracted and intruded to achieve an optimal result.

References


Fig. 19: Abnormal enamel abrasion was noted on the left central incisor once the crossbite was corrected.
**Discrepancy Index Worksheet**

**TOTAL D.I. SCORE** 18

### OVERJET

<table>
<thead>
<tr>
<th>Overjet</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mm. (edge-to-edge)</td>
<td>1 pt.</td>
</tr>
<tr>
<td>1 – 3 mm.</td>
<td>0 pts.</td>
</tr>
<tr>
<td>3.1 – 5 mm.</td>
<td>2 pts.</td>
</tr>
<tr>
<td>5.1 – 7 mm.</td>
<td>3 pts.</td>
</tr>
<tr>
<td>7.1 – 9 mm.</td>
<td>4 pts.</td>
</tr>
<tr>
<td>&gt; 9 mm.</td>
<td>5 pts.</td>
</tr>
</tbody>
</table>

Negative OJ (x-bite) 1 pt. per mm. per tooth = 4

**OVERBITE**

<table>
<thead>
<tr>
<th>Overbite</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 3 mm.</td>
<td>0 pts.</td>
</tr>
<tr>
<td>3.1 – 5 mm.</td>
<td>2 pts.</td>
</tr>
<tr>
<td>5.1 – 7 mm.</td>
<td>3 pts.</td>
</tr>
<tr>
<td>Impinging (100%)</td>
<td>5 pts.</td>
</tr>
</tbody>
</table>

Total = 0

### ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth then 1 pt. per additional full mm. per tooth

Total = 0

### LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

### CROWDING (only one arch)

<table>
<thead>
<tr>
<th>Crowding</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 3 mm.</td>
<td>1 pt.</td>
</tr>
<tr>
<td>3.1 – 5 mm.</td>
<td>2 pts.</td>
</tr>
<tr>
<td>5.1 – 7 mm.</td>
<td>4 pts.</td>
</tr>
<tr>
<td>&gt; 7 mm.</td>
<td>7 pts.</td>
</tr>
</tbody>
</table>

Total = 1

## OCCLUSION

<table>
<thead>
<tr>
<th>Occlusion</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I to end on</td>
<td>0 pts.</td>
</tr>
<tr>
<td>End on Class II or III</td>
<td>2 pts. per side</td>
</tr>
<tr>
<td>Full Class II or III</td>
<td>4 pts. per side</td>
</tr>
<tr>
<td>Beyond Class II or III</td>
<td>1 pt. per mm. additional</td>
</tr>
</tbody>
</table>

Total = 0

### LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

### BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

### CEPHALOMETRICS (See Instructions)

- **ANB**
  - $\geq 6^\circ$ or $\leq -2^\circ$ = 4 pts.
  - Each degree $< -2^\circ$ x 1 pt. =
  - Each degree $> 6^\circ$ x 1 pt. =

- **SN-MP**
  - $\geq 38^\circ$ = 2 pts.
  - Each degree $> 38^\circ$ x 2 pts. = 6
  - $\leq 26^\circ$ = 1 pt.
  - Each degree $< 26^\circ$ x 1 pt. = 4

- 1 to MP $\geq 99^\circ$ = 1 pt.
  - Each degree $> 99^\circ$ x 1 pt. =

Total = 13

### OTHER (See Instructions)

<table>
<thead>
<tr>
<th>Other</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supernumerary teeth</td>
<td>x 1 pt. =</td>
</tr>
<tr>
<td>Ankylosis of perm. teeth</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Anomalous morphology</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Impaction (except 3rd molars)</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Midline discrepancy (\geq 3mm)</td>
<td>@ 2 pts. =</td>
</tr>
<tr>
<td>Missing teeth (except 3rd molars)</td>
<td>x 1 pts. =</td>
</tr>
<tr>
<td>Missing teeth, congenital</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Spacing (4 or more, per arch)</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Spacing (Mx cent. diastema $\geq 2mm$)</td>
<td>@ 2 pts. =</td>
</tr>
<tr>
<td>Tooth transposition</td>
<td>x 2 pts. =</td>
</tr>
<tr>
<td>Skeletal asymmetry (nonsurgical tx)</td>
<td>@ 3 pts. =</td>
</tr>
<tr>
<td>Addl. treatment complexities</td>
<td>x 2 pts. =</td>
</tr>
</tbody>
</table>

Identify: 0
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.
**IBOI Pink & White Esthetic Score**

**Total Score:** 

![Image of teeth with pink and white esthetics scores marked]

1. **Pink Esthetic Score**

   - 1. M & D Papillae: 0 1 2
   - 2. Keratinized Gingiva: 0 1 2
   - 3. Curvature of Gingival Margin: 0 1 2
   - 4. Level of Gingival Margin: 0 1 2
   - 5. Root Convexity (Torque): 0 1 2
   - 6. Scar Formation: 0 1 2

   **Total = 3**

2. **White Esthetic Score (for Micro-esthetics)**

   - 1. Midline: 0 1 2
   - 2. Incisor Curve: 0 1 2
   - 3. Axial Inclination (5°, 8°, 10°): 0 1 2
   - 4. Contact Area (50%, 40%, 30%): 0 1 2
   - 5. Tooth Proportion (1:0.8): 0 1 2
   - 6. Tooth to Tooth Proportion: 0 1 2

   **Total = 3**