Mandibular changes associated with maxillary impaction and molar intrusion

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Received 29 October 2013; revised 29 November 2013; accepted 11 December 2013

ABSTRACT
We report a case series of ten patients who presented with anterior open bite. The initial evaluation included clinical pictures, lateral cephalometric radiographs and dental casts. They were assessed according to the severity of the open bite and the cause (skeletal or dental). They all underwent orthodontic treatment as an initial step. Five patients with dental open bite underwent molar intrusion using titanium screws and five patients underwent maxillary Le Fort I impaction. We report the mandibular changes associated with these different treatment modalities with improved esthetics.

Keywords: Maxillary Impaction; Molar Intrusion; Open Bite; Le Fort I; Titanium Screws

1. INTRODUCTION
Vertical Maxillary Excess (VME) is one of the most frequently encountered dentofacial deformities. This can result in an anterior open bite or an unesthetic gummy smile. The correction of vertical problems with or without open bite usually includes maxillary Le Fort I impaction [1]. On the other hand, the correction of an open bite can be managed orthodontically by molar intrusion [2].

The mandible in such cases is either retrognathic or within normal position and will respond to the superior positioning of the maxilla by autorotation. In some cases this autorotation will add the need to perform mandibular surgery to either advance or setback the mandible and is case-dependent [3,4]. With the mandibular autorotation, the chin position advances. This can be estimated in the presurgical prediction, but requires great accuracy as this will decide if only maxillary Le Fort I impaction will need or two jaw surgeries. Some studies have been made for predicting mandibular autorotation following maxillary impaction [5,6]. However, controversies in locating the center of mandibular autorotation revealed the inability to accurately predict the final position of the mandible after maxillary impaction [6-8]. On the other hand, it has been documented that the mandible will move forward following maxillary impaction with a chin advancement in 1:1 ratio [9].

Molar intrusion is used to manage an open bite. A number of patients do not wish to perform orthognathic surgery because of the involved risk. For such patients, various alternatives can be used, including multibrackets in conjunction with high-pull headgear therapy (2), multiple-loop edgewise arch wire (MEAW) therapy (3), reversed curve nickel-titanium wire with intermaxillary elastics (4) and extraction therapy (5). These treatment modalities can achieve acceptable overbite and interincisal relationship which also guide the mandible and chin into a new position leading to a more esthetic appearance [10].

In this article we present a series of cases. Some underwent orthodontic molar intrusion and others underwent maxillary Le Fort I impaction. We compare the changes in mandibular position and the resulting esthetic improvement for each technique.

2. PATIENTS AND METHODS

10 patients presented to our joint maxillofacial surgery and orthodontics clinic. Their age group varied between 15 and 27 years. Their chief complaint included a combination of anterior open bite and “a gummy smile”. They all underwent a detailed clinical examination which included, radiographs (lateral cephalograms, orthopantomograms OPG), dental models and photographs. Cephalometric analysis was done for all 10 patients using Stener analysis. The treatment plan was established after correlating cephalometric analysis with clinical presenta-
tion and the chief complaint. The treatment plan for patients diagnosed with vertical maxillary excess and retrogнатhia included presurgical orthodontic treatment (leveling, alignment and decompensation) followed by maxillary Le fort I osteotomy with impaction and fixation using four 1.5 mm miniplates. This was followed by an advancement genioplasty according to patients need. However, patients diagnosed with anterior open bite without vertical maxillary excess underwent orthodontic treatment. The cause of the anterior open bite in these cases was suggested to have been extrusion of both upper molars, based on cephalometric readings, therefore, the plan was to intrude both upper molars using implanted titanium screws to deliver the force.

3. ORTHODONTIC TREATMENT FOR OPEN BITE

Bonding and banding of all teeth, using 0.022-inch slot, preadjusted edgewise appliances were placed in both arches (Victory Series™, Roth Rx, 3M Unitek, Monrovia, CA, USA) and leveling and aligning phase using progressive sequencing of arch wires. was performed. Correction of the two-step occlusal plane was done during the leveling and aligning phase by extrusion of anterior teeth. Once a heavy stainless steel arch wire (0.019” × 0.025”) was reached, Titanium screws (1.6-mm diameter, 8-mm length; (RMO Co. Ltd., Denver, Colorado, USA) were inserted bilaterally in the alveolar bone of the maxilla through the buccal mucosa between the second bicuspid and the first molar from both the labial and palatal area in some patients as needed. All the screws were implanted at the same visit under local anesthesia was administered. Analgesics were prescribed to the patients for 3 days after the implantation. One week after implantation of the titanium screws, intrusion of posterior teeth began using elastic chains. The total active treatment period was 19 months. The implant screw anchorage was stable for the entire duration of the treatment, and the screws were removed during the retention phase. Another cephalometric radiograph was taken upon completion of orthodontic treatment and Stiner analysis was repeated.

4. RESULTS

Five patients with anterior open bite and VME underwent orthognathic surgery (Le fort I maxillary impaction with more posterior impaction. An advancement genioplasty was also done in three patients. Five patients with anterior open bite underwent orthodontic treatment only. The results of the cephalometric analysis are listed in (Table 1). The counter clockwise rotation of mandibular plane improved the chin position in three patients who underwent orthodontic treatment (Figure 1) and in all five patients who underwent maxillary impaction this was demonstrated by a decrease in mandibular plane angle and an increase in SNA (Figure 2). Two patients who underwent orthodontic treatment for closure of anterior open bite showed clockwise rotation of the mandibular plane with an increase in mandibular plane angle and a minimal decrease in SNB. However, all patients showed improvement in facial profile and function. The

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Dx</th>
<th>Incisal show at rest</th>
<th>Open bite (mm)</th>
<th>Man plane</th>
<th>Occlusal plane</th>
<th>Point B to N┴FH</th>
<th>SNB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DOB</td>
<td>3 mm</td>
<td>5 mm</td>
<td>30</td>
<td>14</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>DOB</td>
<td>3 mm</td>
<td>4 mm</td>
<td>47</td>
<td>16</td>
<td>10</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>DOB</td>
<td>2</td>
<td>4 mm</td>
<td>38</td>
<td>17</td>
<td>9</td>
<td>85</td>
</tr>
<tr>
<td>4</td>
<td>DOB</td>
<td>3</td>
<td>5 mm</td>
<td>35</td>
<td>15</td>
<td>6</td>
<td>82</td>
</tr>
<tr>
<td>5</td>
<td>DOB</td>
<td>4 mm</td>
<td>5 mm</td>
<td>39</td>
<td>18</td>
<td>6</td>
<td>81</td>
</tr>
<tr>
<td>6</td>
<td>VME</td>
<td>5 mm</td>
<td>4 mm</td>
<td>52</td>
<td>19</td>
<td>13</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
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<td>4 mm</td>
<td>49</td>
<td>17</td>
<td>10</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>VME</td>
<td>8 mm</td>
<td>-</td>
<td>42</td>
<td>13</td>
<td>55</td>
<td>80</td>
</tr>
<tr>
<td>9</td>
<td>VME</td>
<td>6 mm</td>
<td>3 mm</td>
<td>35</td>
<td>13</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>10</td>
<td>VME</td>
<td>6 mm</td>
<td>7 mm</td>
<td>33</td>
<td>15</td>
<td>26</td>
<td>68</td>
</tr>
</tbody>
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Table 1. Cephalometric values for patients who underwent molar intrusion and patients who underwent maxillary impaction (DX: diagnosis; DOB: dental anterior open bite).
retrognathic chin and convex profiles were corrected, resulting in a straight profile. The facial proportions were also improved due to of the decrease in the lower facial height. The strain in the circumoral musculature during lip closure was improved.

5. DISCUSSION

Many studies in the literature mention the esthetic effects of maxillary Le Fort I impaction related to the resulting mandibular counter clockwise rotation [1,3,4]. However, not much is mentioned regarding the effect of molar intrusion on the mandibular plane angle and the resulting esthetic effect. The results of our study showed that molar intrusion used to close anterior open bite gives some esthetic results as seen in maxillary Le Fort I impaction. However, this was not noted in all orthodontically treated cases with anterior open bite.

The esthetic changes resulting from maxillary impaction are mostly related to the degree of mandibular autorotation. The published data on this subject focused mainly on prediction analysis of mandibular autorotation following maxillary impaction [3,4]. Chin position was advanced in all patients who underwent Le Fort I impaction and this was noted in the literature by counter clockwise rotation of the mandible and an increase in SNB and NB-Pog. However, we only used SNB to demonstrate the effect of maxillary impaction on mandible position and NB-Pog was not used to demonstrate the amount of postoperative mandibular advancement in patients who underwent maxillary impaction due to the fact that three patients required genioplasty to further improve esthetics.
Patients who underwent orthodontic treatment for open bite closure showed improved esthetics, however, not all patients showed mandibular counter clockwise rotation as seen in Le Fort I impaction. Some patients showed clockwise mandibular rotation. This was explained by the orthodontic treatment, since two of the patients have constricted maxilla. Expansion appliance such as Quad-Helix was used to expand the maxillary teeth. It is well documented with expansion clock wise rotation of the mandibular plane which has taken place due to extrusion of the palatal cusp. The clock wise rotation point pog will also rotate backward. The difference between pre and post treatment was in average 2 degrees which could be due to the occlusal plane measured at functional occlusion with no anterior teeth contacting a measurement error that was possible. The most important is the reduction of the mandibular plane which showed a counter clock wise rotation in all the patients with esthetic improvement.

On the other hand, the skeletal improvement is poor due to failure to establish absolute anchorage during molar intrusion. To obtain absolute anchorage, several devises have been used such as dental implant [11-14], screws [15,16] and miniplates [17,18]. The advantages of these devices are by providing absolute anchorage different teeth movement without the need for patient’s cooperation. Several reports have been reported on the use of screw for anchorage in teeth movement, intrusion or retraction of anterior teeth [10,11], and protraction of posterior teeth in the mandible. In addition, few papers have reported the use of titanium screws for orthodontic anchorage to intrude upper and/or lower molars of an adult patient with severe skeletal anterior open bite.

The mandible will follow any changes in occlusion resulting from maxillary impaction or molar intrusion. The noted changes in mandibular and chin position were quite variable and less predictable following molar intrusion, however, the improved esthetics can be appreciated in all patients. Future standardized studies will help us make accurate predictions following molar intrusion or maxillary impaction.

References


International Journal of Adult Orthodontics & Orthognathic Surgery, 13, 201-209.
