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Camouflage Treatment in Adult Patient with Mandibular Lateral Displacement, Transverse Deficiency and Facial Asymmetry – A Case Report

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Facial asymmetry is common in humans. Significant facial asymmetry causes both functional as well as esthetic problems. The etiologies of facial asymmetry include congenital disorders, acquired diseases, and traumatic and developmental deformities. The causes of many cases of developmental facial asymmetry are indistinct. The principle of facial asymmetry management would be correcting the underlying disorder. Orthognathic surgery is the first and better choice if face correction is the primary consideration. Camouflage orthodontic treatment was a non-invasive option for mild to moderate severity of asymmetry.

We present a case with mandibular lateral displacement, transverse deficiency and facial asymmetry in a 19-year-old female. Camouflage orthodontic treatment was chosen by the patient and her family. Removable ball-type palatal expander with slow adjustment was delivered to correct bilateral posterior cross-bite and guided the maxilla for limited lateral expansion. Full mouth was bonded with Tip-Edge brackets and combined with asymmetry elastic for distalization of lower right molar and midline correction.

Treatment outcome showed unilateral anterior cross-bite, bilateral posterior cross-bite, functional shift and midline deviation were corrected. Bilateral canine and molar class I relationship were achieved. Degree of facial asymmetry was also improved. The treatment result achieved was very satisfactory. Then the patient was referred to Department of Prosthetics for further prosthetic treatment. (Taiwanese Journal of Orthodontics. 29(2): 86-98, 2017)

Keywords: bilateral posterior cross-bite; facial asymmetry; Tip-Edge bracket
INTRODUCTION

Perfect bilateral face and body symmetry seldom exist in living organisms. Minor facial asymmetry found in normal individuals, even in those with aesthetically attractive face, are usually indiscernible and does not require any treatment. The point at which “normal” asymmetry becomes “abnormal” cannot be easily defined and is often determined by clinician’s sense of balance and the patient’s sense of imbalance.\(^1\) It has been reported that by collating photographs of the right and left sides of a “normal” face with their respective mirror images, three faces could be visualized.\(^2\)

Significant facial asymmetry causes both functional as well as esthetic problems. The etiology of facial asymmetry includes congenital disorders, acquired diseases, traumatic and developmental deformities.\(^2\) However, the causes of many developmental facial asymmetry are indistinct.

Mandibular lateral displacement (ie. MLD) is relatively common in patients with malocclusion. MLD is clinically characterized by deviation of the chin, facial asymmetry, dental midline discrepancy, cross-bite in posterior regions, and high prevalence of internal derangement of the temporomandibular joint.\(^3-5\)

The principle of facial asymmetry management would be correcting the underlying disorder. Orthognathic surgery is the first and better choice, unless appearance is the primary consideration. Camouflage orthodontic treatment was chosen by most patients, instead of surgical orthodontic treatment. For clinicians, MLD is a challenging anomaly and the results can sometimes be compromised. Owing to the asymmetry of the skeletal frame, orthodontic treatment is difficult, even for experienced orthognathic surgeons.\(^2\)

This study reported a clinical case of MLD, transverse deficiency and facial asymmetry receiving camouflage orthodontic treatment.

CASE STUDY

(A) Clinical data and examination

A 19-year-old female patient came for orthodontic treatment with the main complaint of malocclusion. Past medical history and trauma history were denied. The frontal view of the patient revealed asymmetry with mandible deviated to the left and canting bilateral lip height. Visibility of upper incisors at rest was 2-3 mm. Her lips were competent at rest and no gingival tissue was displayed when smiling. The lateral view of the patient revealed normal nasolabial angle and a convex facial lateral profile with protrusive lower lip (Figure 1).

Intraorally, she had dental midline deviation. The dental midline of upper arch was deviated to the right by 2 mm, while that of lower arch was deviated to the left by 4 mm. Full cross-bite of the left and posterior cross-bite of the right were also observed. Canine relationship revealed a Class II relationship of the left and a Class III relationship of the right (Figure 1).

Dental conditions examined from clinical or panoramic film revealed the following problems (Figures 1 and 2A) : (1) dental caries of tooth 15 with large decay, (2) residual root of tooth 16, (3) previously endodontic and prosthetic treatment of tooth 21, 22 and 25, (4) tooth 36 missing, and (5) temporary capping with IRM of tooth 46. Additionally, unbalanced bilateral mandibular ramus height was also noted from panoramic film. Lateral cephalometric analysis (Figure 2B and Table 1) revealed a skeletal Class III relationship with prominent chin and an average mandibular plane angle. Dental inclination showed normal inclination of upper incisors to the SN plane and retroinclination of lower incisors to the mandibular plane. Soft tissue analysis revealed a normal nasolabial angle and protrusive lower lip.

Facial morphology was examined using posterior-anterior (PA) cephalograms (Figure 2C, Tables 2-4). The mid-facial reference plane for assessing facial asymmetry...
Figure 1. Pretreatment extraoral and intraoral photographs.

Table 1. Lateral cephalometric analysis

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Final</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-N</td>
<td>65.1 mm</td>
<td>64.6 mm</td>
<td>71.3 ± 3 mm</td>
</tr>
<tr>
<td>SNA Angle</td>
<td>87.3°</td>
<td>87.7°</td>
<td>82.9 ± 2.8°</td>
</tr>
<tr>
<td>SNB Angle</td>
<td>89°</td>
<td>86.5°</td>
<td>80.8 ± 2.5°</td>
</tr>
<tr>
<td>ANB Angle</td>
<td>-1.6°</td>
<td>1.2°</td>
<td>2.1 ± 1.5°</td>
</tr>
<tr>
<td>Pog to Nasion ver.</td>
<td>3.9 mm</td>
<td>1.7 mm</td>
<td>-6.6 ± 2.9 mm</td>
</tr>
<tr>
<td>SN-MP (Go-Gn)</td>
<td>32.1°</td>
<td>33.2°</td>
<td>30.9 ± 3.9°</td>
</tr>
<tr>
<td>U1 – SN (Angle)</td>
<td>110.4°</td>
<td>109.7°</td>
<td>106.3 ± 4.9°</td>
</tr>
<tr>
<td>L1 – MP (Angle)</td>
<td>88.4°</td>
<td>82.7°</td>
<td>94.1 ± 5°</td>
</tr>
<tr>
<td>Nasolabial Angle</td>
<td>89.5°</td>
<td>94.4°</td>
<td>90.5 ± 11.9°</td>
</tr>
<tr>
<td>Upper lip – E line</td>
<td>1.2 mm</td>
<td>0.5 mm</td>
<td>1.9 ± 1.2 mm</td>
</tr>
<tr>
<td>Lower lip – E line</td>
<td>4.9 mm</td>
<td>3.2 mm</td>
<td>1.8 ± 1.6 mm</td>
</tr>
</tbody>
</table>

Table 2. The degree of MLD

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLD value</td>
<td>15°</td>
<td>13°</td>
</tr>
</tbody>
</table>

Figure 2. Pretreatment panoramic (A), lateral cephalometric (B) and posterior-anterior cephalometric (C) radiographs.
was a line running through the anterior nasal spine and menton defined as the degree of MLD (Figure 3). A positive value indicated MLD to the left and a negative value, MLD to the right (Table 3). Angulation and the distance between the line of the mid-facial plane and the line connecting the medial aspect of bilateral zygomatic-frontal suture (Z plane), the line running through the bilateral jugal process (J plane), the line running through the occlusal surface of bilateral molar (OP plane), and the line connecting the right and left antegonial notches (AG plane) were measured. Positive values of OP and AG indicated that these planes inclined superiorly toward the left.

As seen in Table 3, differences between the right and left angulation increased from Z plane to AG plane. Table 4 shows that both J distance and AG distance of right were larger than those of the left. Additionally, the difference in AG distance was larger than that in J distance. Comparing to normal value of maxilla and mandible width in this case reveals that the value of maxilla width was smaller than the normal value, while that of mandible width was with normal range.

<table>
<thead>
<tr>
<th>Plane \ (%)</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z plane</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>J plane</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>OP plane</td>
<td>94</td>
<td>95.5</td>
</tr>
<tr>
<td>AG plane</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z plane</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>J plane</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>AG plane</td>
<td>36</td>
<td>36.5</td>
</tr>
</tbody>
</table>

As seen in Table 3, differences between the right and left angulation increased from Z plane to AG plane. Table 4 shows that both J distance and AG distance of right were larger than those of the left. Additionally, the difference in AG distance was larger than that in J distance. Comparing to normal value of maxilla and mandible width in this case reveals that the value of maxilla width was smaller than the normal value, while that of mandible width was with normal range.
These result indicated that the maxilla showed developmental deficiency and the mandible was shifted to the left in this case.

(B) Diagnosis

According to the clinical data and X-ray analysis including panoramic film, lateral and PA cephalometric radiographs, the skeletal diagnosis was Class III pattern with facial asymmetry, maxilla transverse deficiency and uneven bilateral mandibular ramus and the dental diagnosis was Class II left canine and Class III right canine with unilateral anterior cross-bite, bilateral posterior cross-bite, occlusal plane canting, midline deviation and mandibular lateral displacement. Dental caries of tooth 15, residual root of tooth 16 and missing of tooth 36 were also noted.

According to the clinical data and X-ray analysis including panoramic film, lateral and PA cephalometric X-ray films, the following diagnoses were made.

1. Skeletal diagnosis is Class III pattern with facial asymmetry, maxilla transverse deficiency and uneven bilateral mandibular ramus.
2. Dental diagnosis is Class II left canine and Class III right canine with unilateral anterior cross-bite, bilateral posterior cross-bite, occlusal plane canting, midline deviation and MLD.
3. Tooth diagnosis:
   A. Tooth 15 dental caries
   B. Tooth 16 residual root
   C. Tooth 21,22,25 previous endodontic treatment, periapical films indicated apical periodontitis
   D. Tooth 36 missing

(C) Treatment suggestions and plans

A surgical-orthodontic treatment plan was suggested for achieving a better facial profile within a shorter time. However, the option of surgery was declined by the patient and her family in view of surgical risks and higher costs; hence, camouflage orthodontic treatment was chosen instead. The treatment plan involved performing the following procedures. (1) Teeth 16 and 48 were extracted. (2) Removable ball-type palatal expander with slow adjustment was delivered to correct bilateral posterior cross-bite and to guide the maxilla for limited lateral expansion. (3) Biting force training was also given to prevent extrusion of upper posterior teeth. (4) Full mouth was bonded with Tip-Edge brackets. (5) Teeth 17 and 18 were protracted to close tooth 16 space. (6) Tooth 36 space was maintained for further prosthetic treatment. (7) The treatment was combined with asymmetry elastic for distalization of lower right molar and midline correction.

(D) Treatment objectives

Treatment main objective for this patient was to correct dental problems by camouflage treatment. Tooth 36 space was maintained for further prosthetic treatment. The overall treatment objectives were to achieve Class I canine relationship, obtain normal overjet and overbite, correct unilateral anterior cross-bite, correct bilateral posterior cross-bites, correct mandibular lateral displacement, correct functional shift problem and improve lateral profile.

<table>
<thead>
<tr>
<th>Table 5. Measurement of basal bone width.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Maxilla</td>
</tr>
<tr>
<td>Mandible</td>
</tr>
<tr>
<td>Md. - Max</td>
</tr>
</tbody>
</table>
The treatment objectives were as follows.

1. Skeletal problem: maintenance
2. Dentition problem:
   a. Endodontic and restorative treatment of tooth 15
   b. Extraction of tooth 16 and protraction of teeth 17 and 18
   c. Maintenance of tooth 36 space for further prosthetic treatment
3. Occlusion:
   a. Achieve Class I canine relationship
   b. Obtain normal overjet and overbite
   c. Correct unilateral anterior cross-bite
   d. Correct bilateral posterior cross-bites
   e. Correct MLD and functional shift problem
4. Lateral profile:
   a. Maintain position of upper lip
   b. Reduce protrusion of lower lip

(E) Treatment progress

Removable ball-type palatal expander with slow adjustment was delivered for 7 months (Figure 4A). Expansion protocol was 0.5 mm per week. Biting force training was also given for preventing extrusion of posterior teeth. Full mouth was bonded with 0.022 slot of Tip-Edge brackets. 0.016-inch Ni-Ti and 0.016x0.022-inch thermal Ni-Ti was placed on the upper and lower arch for leveling and alignment, respectively. Intra-arch elastics (3.5oz) were also employed to correct posterior cross-bite of the left (Figure 4B). Transverse palatal appliance, which banded from tooth 17 to tooth 27, was delivered for maintenance after expansion (Figure 4C). An 0.018-inch Australian archwire and an 0.018x0.025-inch stainless-steel archwire was placed on the upper and lower arch in the 21th month, respectively. Asymmetry elastics were combined for lower right molar distalization and midline correction. (E) Settle-down elastics were used for maximum intercuspation in the 44th month.

Figure 4. Treatment progress. (A) Removable ball-type palatal expander with slow adjustment was delivered for 7 months (B) Intra-arch elastics (3.5oz) were also employed to correct posterior cross-bite of the left (C) Transverse palatal appliance was delivered for maintenance after expansion (D) 0.018-inch Australian archwire and 0.018x0.025-inch stainless-steel archwire was placed on the upper and lower arch in the 21th month, respectively. Asymmetry elastics were combined for lower right molar distalization and midline correction. (E) Settle-down elastics were used for maximum intercuspation in the 44th month.
inch stainless-steel archwire was placed on the upper and lower arch in the 21th month, respectively. Upper right-side teeth was protracted with power chain and asymmetry elastics were combined for lower right molar distalization and midline correction (Figure 4D). Settle-down elastics were used for maximum intercuspation in the 44th month (Figure 4E).

(F) Treatment results

After 46 months of active treatment, all fixed appliances were removed and post-treatment records were taken (Figures 5 and 6). Lateral and posterior-anterior cephalometric analyses were indicated from Table 1 to 4. The cephalometric tracings and superimpositions were demonstrated in Figure 7.

This treatment achieved the following results. Unilateral anterior cross-bite, bilateral posterior cross-bite, functional shift and midline deviation were all corrected. Teeth 17 and 18 were protracted to close tooth 16 space. Bilateral canine Class I relationships were achieved. Degree of facial asymmetry was also improved. The

![Figure 5](image1.png)

**Figure 5.** Extraoral and intraoral photographs after 46 months completion of orthodontic treatment.

![Figure 6](image2.png)

**Figure 6.** Panoramic (A), lateral cephalometric (B) and posterior-anterior cephalometric (C) radiographs after 46 months completion of orthodontic treatment.
result achieved was very satisfactory. Then the patient was referred to the Department of Prosthetics for further prosthetic treatment.

DISCUSSION

Correction of facial asymmetry is becoming an important goal of orthodontic treatment and orthognathic surgery. Many reports mentioned that all patients have some craniofacial asymmetry, including those perceived as normal. Ferrario et al observed an occlusal cant of 0 to 3 degree in normal, healthy patients. Therefore, it is widely recognized that facial asymmetry occurs often in the normal craniofacial complex.

Facial asymmetry affects the lower face more frequently than the upper face. Severt and Proffit reported the frequencies of facial asymmetry of 5%, 36%, and 74% in the upper, middle, and lower thirds of the face, respectively. The lower part of the faces deviates more frequently and at greater distances than the upper and middle parts. One of the explanations is longer period of mandible growth in the lower facial portion. This is
why Lee et al.\textsuperscript{10} and Ahn and Hwang highlighted that mandibular chin point deviation is the most effective method for facial asymmetry assessment.\textsuperscript{11}

McNamara reported that the dentofacial complex is obviously adaptable to the functional demand in occlusal configuration and the change of occlusal function in growing facial bones.\textsuperscript{12,13} Ishizaki also thought that the occlusal plane is an important element in positioning and adapting the mandible.\textsuperscript{14} Continuous horizontalization of the sagittal occlusal plane during the growth process induces forward adaptation of the mandible by anterior rotation, consequently establishing a Class III skeletal frame, whereas a steep occlusal plane induces Class II skeletal problems.

Ishizaki reported that MLD is not due to simple mandibular lateral shift, but rather the mandible was three-dimensionally rotated along with condylar displacement to the contralateral side.\textsuperscript{14} Two possible mechanisms were suggested to account for the development of MLD. The first possible reason is that the difference in vertical height of the dentition on both sides creates an occlusal fulcrum on the posterior molar of the higher side. Reduced vertical height of the dentition on one side induced mandibular lateral adaptation with contralateral condylar shift; leading to condylar lateral shift during functional movement. The second possible reason is that the difference in occlusal guidance between the two sides causes a slight mandibular shift with a consequent unilateral chewing habit. It causes more occlusal load on the chewing side and prevents eruption of teeth on the chewing side, tilts the OP superiorly to the same side, and compresses the condyle against the glenoid fossa on the chewing side (Figure 8).

For clinicians, MLD is a challenging anomaly and its results can sometimes be compromised. The asymmetry of the skeletal frame poses difficulties even for an experienced orthognathic surgeons. For most patients, camouflage treatment is the more preferred option. Burstone suggested that it is necessary to maintain the asymmetry of axial inclinations for nonsurgical adult patients.\textsuperscript{15}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image.png}
\caption{Schematic drawing of development of MLD. OP, Frontal occlusal plane; AG, frontal mandibular plane. (From Am J Orthod Dentofac Orthop 137:454e451-459, 2010)}
\end{figure}
The average width of maxilla is 66.2 mm for normal adults. However, it is 59 mm for the present case diagnosed with maxilla transverse deficiency. Normal palatal growth is nearly complete by age 6, and increasing interdigitation of the suture makes separation difficult to achieve after puberty. Once patients pass their growth spurt, which occurs around the age of 12-13 years in females and 14-15 years in male, the protocol for rapid palatal expansion is not as clear. When the sutures mature, rapid orthopedic palatal expansion occurs mainly via dental tipping and alveolar bone bending, rather than skeletal movement. It could cause complications such as buccal tipping of teeth, extrusion, root resorption, and fenestration of the alveolar process, leading to periodontal side effects.

Bilateral jugal distances (Table 6) and molar axial angulation (Table 7) were measured from posterior-anterior cephalograms to determine the effect of the palatal expander. Width of upper 3-3 and upper 7-6 were also measured from plaster model (Table 7). There were only slight differences between initial and final treatment for jugal distance, width of upper 3-3 and upper 7-6. However, only molar axial angulation of posterior segments showed significant difference, indicating that expansion of upper arch is due to dental movement, rather than skeletal movement. Furthermore, posterior segments of the upper arch tipped buccally while the lower arch tipped lingually were also observed from the plaster model (Figure 9). It is concluded that dental tipping can compensate jaw bone discrepancy in this kind of nonsurgical adult patient.

### Table 6. Intermolar angulation

<table>
<thead>
<tr>
<th>Intermolar angulation</th>
<th>Initial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper</td>
<td>11°</td>
<td>30°</td>
</tr>
<tr>
<td>Lower</td>
<td>22°</td>
<td>62°</td>
</tr>
</tbody>
</table>

### Table 7. Measurement of arch width

<table>
<thead>
<tr>
<th>Width(mm)</th>
<th>Initial</th>
<th>Final</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3-3</td>
<td>35 mm</td>
<td>36 mm</td>
<td>1 mm</td>
</tr>
<tr>
<td>Upper 7-6</td>
<td>55 mm</td>
<td>57 mm</td>
<td>2 mm</td>
</tr>
<tr>
<td>Lower 7-7</td>
<td>56 mm</td>
<td>52 mm</td>
<td>4 mm</td>
</tr>
</tbody>
</table>

**Figure 9.** Posterior segments of upper arch tipped buccally (A) while the lower arch tipped lingually (B) were also observed from the plaster model.
In the present case, the lower right first molar was tipped back 4 mm and uprighted. This effect was achieved without screw or extra appliances but using the special bracket system, which is the Tip-Edge straight-wire system. Tip-Edge brackets were derived from a single .022-inch straight-wire bracket merely by cutting away two diametrically opposite corners from the archwire slot (Figure 10). Differential tooth movement can be achieved with this special design.

The characteristic of Tip-Edge straight-wire technique is the tipping movement of teeth with a light and continuous force. The initial force of Class III elastics is light, about 50-60g.1,21-25 Intraoral anchorage is adequate, without the need of extra-oral force to increase the anchorage. A tipping movement of teeth is much easier than a bodily movement; therefore, the range of movement is larger. Lin et al.26 reported that successful treatment effects can be obtained with nonsurgical therapy in severe skeletal Class III malocclusion in the permanent dentition using Tip-Edge straight-wire technique and Begg light wire technique. These methods allow a larger range for tipping of teeth with significant but limited skeletal change. Forward movement of the upper teeth and backward movement of the lower teeth contributed to the correction of the anterior cross-bites and achieving a Class I molar relationship. This theory was successfully utilized to distalize the lower right molar and to correct midline deviation by light and continuous Class III force in the present case.

The extent of lip canting, occlusal canting and chin deviation were improved after camouflage treatment (Table 2, Figures 7B and 11). The extent of MLD to the left in the present case was initially about 15°and decreased to 13° degrees after treatment. Although the

**Figure 10.** Single straight-wire bracket minus two diametrically opposite wedges = Tip-Edge (From text book of Tip-Edge Orthodontics and the Plus bracket)

**Figure 11.** The extent of lip canting, chin deviation (A), and occlusal canting (B) were improved after camouflage treatment.
difference in skeletal change is only 2°, the extent of asymmetry in soft tissue was significantly changed. It is suggested by Pecket et al. that many people with skeletal asymmetry have a symmetric face, and that there are differences between skeletal and soft-tissue asymmetries. Michaels and Tourne and Yogosawa reported that skeletal deformities can be hidden by soft tissues such as muscles and skin. Moreover, Robinson et al. reported that a beautiful face should be harmonious with comparable size and position of the skeletal structures and soft tissue. They stated that a favorable face can be shown by the soft tissue. In addition, Haraguchi et al. reported differences between the degrees of actual skeletal asymmetry and soft-tissue asymmetry perceived in Class III patients. They emphasized the necessity of soft-tissue analysis.

**CONCLUSIONS**

1. Mandibular chin point deviation is the most effective method for assessing in facial asymmetry. MLD is not due to simple mandibular lateral shift, but rather the mandible three-dimensionally rotated along with condylar displacement to the contralateral side. Differential diagnosis before orthodontic treatment is important.

2. When camouflage treatment is chosen, maintaining the asymmetry of the axial inclinations for nonsurgical adult patients is necessary.

3. Most of maxillary expansion in adult patients is caused by dental movement, rather than skeletal movement. Jaw bone discrepancy in some nonsurgical adult patients can be compensated by dental tipping, but case selection should be also noted.

4. Differential tooth movement can be caused by light and continuous force with Tip-Edge straight-wire technique and Begg light wire technique.

5. A beautiful face should be harmonious with comparable size and position of the skeletal structures and soft tissue.

6. The present case showed successful camouflage treatment in an adult patient with mandibular lateral displacement, transverse deficiency and facial asymmetry. Degree of facial asymmetry was improved and the patient was satisfied with the treatment result.

**REFERENCE**


