Treatment of a Class II subdivision based on occlusal plane control: A clinical case

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It is important to understand the morphologic features of malocclusion to construct a functional occlusion. The features of Class II subdivision malocclusions with mandibular lateral deviation make them especially difficult to correct. This article describes a Class II subdivision clinical case, treated at the first stage with the straightwire technique, which permitted alignment and leveling for 12 months. At the second stage, an occlusal plane modification and mandible repositioning with multiloop edgewise archwires (MEAW) was used for 6 months. Different MEAW activation on either side and occlusal provisional composite restorations (prematurity) in the maxillary left first and second molars became essential to increase the vertical dimension in the affected side, thereby allowing the left premolars to extrude into a Class I relationship. Short vertical elastics in the anterior area (for Class III) on the right side and on the left side (Class II) also applied different orthodontic forces. This procedure made it possible to finish the case with stable sagittal and vertical occlusion relationships between both arches. ORTHODONTICS (CHIC) 2012;13:128–137.

Key words: Class II Division 1, deep bite, MEAW, occlusal plane, subdivision malocclusion

Facial asymmetries can have dental, functional, or skeletal causes (resulting from discrepancies in shape or position of one or more bones of the craniofacial complex or from a combination of the three factors).\(^1,2\)

Under pathologic conditions or with permanent or semipermanent luxation, the condyle has no proper anatomical relationship with the articular disk. Such problems comprise a series of morphofunctional alterations and abnormalities involving temporomandibular articulation, masticatory muscles, and the structures associated with them.\(^3\) There are multiple clinical signs and symptoms, among which are pain (usually at the temporomandibular joint [TMJ]), TMJ noises, TMJ movement restriction, cervical pain, and headaches.\(^4\)

Associations between certain malocclusions and TMJ dysfunction were found in some studies,\(^5\) whereas the majority of the reviewed articles stated that there is little if any evidence-based connection between any malocclusion and TMJ dysfunction.\(^8\)–\(^10\)

The symptoms related to a dysfunctional craniomandibular system increase with age, and the main prevalence of clinical signs has been observed mostly in the permanent dentition.\(^5\) Corvo et al\(^11\) reported that TMJ problems can occur in pediatric populations and most commonly affect females. The most affected age range is from 16 to 18 years. In addition, they reported an increased prevalence in subjects with Class II malocclusions, showing a possible correlation between malocclusion and craniomandibular system dysfunction.
It has also been reported that malocclusions with mandibular lateral displacement are another type of malocclusion for which there is a higher frequency of craniomandibular system dysfunction. Maxillary arch height decrease is not the only factor that accounts for the difference of the vertical dimension in the left and right side. There are some variations: normal vertical dimension of both sides (bilateral Class I), high vertical dimension of both sides but one side is higher (bilateral Class III), low vertical dimension of both sides but one side is lower (bilateral Class II), normal vertical dimension of one side but with a higher other side (unilateral Class III), normal vertical dimension of one side with a higher other side (unilateral Class II), and vertical dimension of one side is high and the other side is lower (one side Class III, one side Class II).

The present case presents the orthodontic treatment of a young patient with a left Class II subdivision with a canted upward occlusal plane on the affected side, treated with a multiloop edgewise archwire (MEAW) technique. With this system, the occlusal plane can be modified and the mandible repositioned.

CLINICAL CASE

Patient history
A 12-year-old girl presented with the chief complaint of bad dental position of the maxillary arch. The secondary complaint was an anterior closed bite (Fig 1).

She had an asymmetric lower third of the face, and the mandible shifted to the left. The occlusal plane canted upward on the affected side.

The patient exhibited a Class I molar and canine relationship on the right side and a Class II molar relationship on the left side. There was a midline discrepancy of about 4 mm, with a 2-mm shift to the right of maxillary dental midline, while the mandibular dental midline was shifted to the left by 2 mm (Fig 1). There was mild crowding in the maxilla with a blocked-out maxillary right canine. Labial tipping of the maxillary anterior teeth with deep bite (overbite of 7 mm) was present. There was a canted upward occlusal plane on the affected side (Fig 2). Crossbite in the left side between the maxillary and mandibular first molars, essentially due to lingual tipping in the maxilla and buccal tipping in the mandible, was evident (Fig 1). The germs of all third molars were present (Fig 3).

Based on the lateral radiograph, two posterior occlusal planes were observed (Fig 4). Lateral cephalometric analysis showed a normal mandibular angle, a skeletal Class II with a normally positioned maxilla, and a posteriorly positioned mandible (Fig 4 and Table 1).

The overbite depth indicator (ODI) consists of two angles, the one between FH and PP and the other one between AB and MP. In this case, the ODI value was slightly high, revealing a slight skeletal closed bite tendency (Table 2).

The anteroposterior dysplasia indicator (APDI) consists of three angular measurements (FH-PP, AB-NPg, and FH-NPg) but corresponds to the angle PP-AB, revealing a skeletal Class II relationship (Table 3).
Articulator analysis of dental casts mounted in centric relation (CR), showed right middle Class II molar relationship. A full Class II molar relationship was observed on the left side.

The mandibular position indicator (MPI), in the centric occlusion (CO), showed a downwardly positioned right condyle ($X = 0, Z = 1$) and backward and downward positioned left condyle ($X = -1, Z = 2$).

The treatment aims were to correct the mandibular position by shifting the mandible to the right side and to allow the right and left condyle to turn upward, thereby making the centric occlusion (CO) and the centric relation (CR) coincident. We also aimed to reconstruct the occlusal plane.

**Treatment plan**

In the first stage, alignment and leveling was accomplished with a straight-wire technique. In the second stage, controlling the occlusal plane was accomplished by repositioning the mandible with the use of maxillary and mandibular MEAWs.

**Treatment**

Due to the dentomaxillary negative disharmony in the maxilla, it was decided to align and level with a sequence of 0.014- and 0.018-inch nickel-titanium (Ni-Ti) wires, which were later replaced with rectangular Ni-Ti $0.016 \times 0.022$-inch and $0.019 \times 0.025$-inch wires. In the mandibular arch, crown alignment and root leveling were achieved with the same procedure (Figs 5 and 6).
Twelve months after treatment began, MEAWs were mounted: 0.016 × 0.022-inch wire was applied with intermaxillary elastics to control the occlusal plane. In addition, occlusal temporary composite restoration (prematurity) was placed in the maxillary left first and second molars, thereby allowing the extrusion of the left premolars (Fig 7). The occlusal composite restorations were then removed, and the maxillary posterior teeth were extruded (Fig 8). Vertical elastics on the right side (Class III) and short Class II elastics on the left side were used in the anterior loops (Figs 7 and 8).

Changing the occlusal plane caused a mandibular right shift, thus improving the patient’s facial symmetry. A stable occlusion was established in the fifth month after the MEAW (Fig 9).

The active treatment with straight wire and MEAWs took 17 months. Post-treatment records were made (Figs 9 to 11). Impressions were taken to create a maxillary retainer. In the mandible, a 0.0175-inch twist flex lingual archwire was bonded to the lingual surfaces of the mandibular incisors and canines (see Fig 9).

**Treatment results**
The major proposed objective, the attainment of a stable dental articulation, was accomplished partly due to good patient cooperation in the use of intraoral elastics during the use of MEAW and in maintaining favorable oral hygiene. Post-treatment photographs showed a bilateral molar and canine Class I relationship. The maxillary midline was aligned with the facial midline, and there was good
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The cephalometric analysis at the end of the treatment allows us to be sure of the changes that occurred due to the treatment and those due to the growth, in an overlapping way (Figs 12 and 13).

Table 1  Cephalometric analysis (Marrifield-Tweed)

<table>
<thead>
<tr>
<th>Cephalometric analysis</th>
<th>Norm</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMIA (degrees)</td>
<td>67 ± 3</td>
<td>70.2</td>
<td>50.4</td>
</tr>
<tr>
<td>FMA (degrees)</td>
<td>25 ± 3</td>
<td>23.4</td>
<td>24.9</td>
</tr>
<tr>
<td>IMPA (degrees)</td>
<td>88 ± 3</td>
<td>86.3</td>
<td>104.7</td>
</tr>
<tr>
<td>SNA (degrees)</td>
<td>82 ± 2</td>
<td>80.3</td>
<td>77.6</td>
</tr>
<tr>
<td>SNB (degrees)</td>
<td>80 ± 2</td>
<td>73.9</td>
<td>71.9</td>
</tr>
<tr>
<td>ANB (degrees)</td>
<td>1–5</td>
<td>6.4</td>
<td>5.7</td>
</tr>
<tr>
<td>Ao Bo (mm)</td>
<td>2 ± 2</td>
<td>5.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Occlusal plane (degrees)</td>
<td>8–12</td>
<td>5.6</td>
<td>8.5</td>
</tr>
<tr>
<td>Angle Z (degrees)</td>
<td>75 ± 5</td>
<td>68.0</td>
<td>68.0</td>
</tr>
<tr>
<td>Facial posterior height (mm)</td>
<td>45</td>
<td>47.4</td>
<td>49.4</td>
</tr>
<tr>
<td>Facial anterior height (mm)</td>
<td>65</td>
<td>65.2</td>
<td>68.9</td>
</tr>
<tr>
<td>Index posterior/anterior</td>
<td>0.69</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Rap. of evol.</td>
<td>2/1</td>
<td>15.9</td>
<td>17.0</td>
</tr>
</tbody>
</table>

Table 2  Overbite depth indicator: Cephalometric measurements for the analysis of vertical components of malocclusion

<table>
<thead>
<tr>
<th>Pretreatment</th>
<th>Posttreatment</th>
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</thead>
<tbody>
<tr>
<td>MP-AB</td>
<td>82.6</td>
</tr>
<tr>
<td>HF-PP</td>
<td>+</td>
</tr>
<tr>
<td>HF-PP</td>
<td>–2.7</td>
</tr>
<tr>
<td>ODI 74, 5 ± 6 degrees</td>
<td>= 79.9</td>
</tr>
</tbody>
</table>

Table 3  Anterior-posterior dysplasia indicator: Cephalometric measurements for the analysis of antero-posterior components of malocclusion

<table>
<thead>
<tr>
<th>Pretreatment</th>
<th>Posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-FP</td>
<td>86.8</td>
</tr>
<tr>
<td>PF-AB</td>
<td>+</td>
</tr>
<tr>
<td>PF-AB</td>
<td>–9.9</td>
</tr>
<tr>
<td></td>
<td>= 76.9</td>
</tr>
<tr>
<td>HF-PP</td>
<td>+</td>
</tr>
<tr>
<td>HF-PP</td>
<td>–2.7</td>
</tr>
<tr>
<td>APDI 81, 4 ± 3.7 degrees</td>
<td>= 74.2</td>
</tr>
</tbody>
</table>

overjet and overbite relationships (Fig 9). The final panoramic radiograph (Fig 10) confirmed good root position.

Fig 3 (above)  Pretreatment panoramic radiograph.

Fig 4 (right)  Pretreatment cephalometric radiograph.

The cephalometric analysis at the end of the treatment allows us to be sure of the changes that occurred due to the treatment and those due to the growth, in an overlapping way (Figs 12 and 13).
The germs of all third molars were removed. After 1 year of retention, the patient reported no TMJ signs or symptoms and a stable occlusion (Fig 14).

**DISCUSSION**

Researchers have concluded that everyone has some kind of craniofacial asymmetry, including people who are perceived to be normal.\(^\text{13,14}\) Several investigations\(^\text{15–18}\) show that remodeling changes take place in the condylar head in response to occlusal alterations. However, there is little if any evidence-based connection between any malocclusion and TMJ dysfunction.\(^\text{8–10}\)
In mandibular lateral deviation, the mandible is not the only structure that is displaced, since the maxilla is also affected. With the use of facebow transfer and articulator mounted models, the difference in the height of the left and right maxilla can be determined. Normally, the chin displaces to the side where the maxillary height is low, just to get occluded (Figs 1 and 2). Orthodontists should therefore realize that midline discrepancy is only one of the symptoms of mandibular lateral displacement and that occlusal deviation and displacement of the mandible may be induced by craniomaxillary system dysfunction in growing children. With this in mind, we will be able to administer the best and most simple treatment management to the patient by skeletal improvement and provide a masticatory organ able to withstand long-term rigor.5

Considering the negative DDM existent in the maxillary arch (Fig 1), the use of the straight-wire technique in the first stage became essential for crown alignment and root leveling. This procedure allowed the use of MEAW only for 6 months. The use of short Class III elastics at the right side and short Class II elastics at the left side in the anterior teeth became easier. The temporary
Fig 9  Posttreatment extra- and intraoral photographs.

Fig 10 (above)  Posttreatment panoramic radiograph.

Fig 11 (right)  Posttreatment cephalometric radiograph with coincident posterior occlusal planes.
occlusal restorations (prematurity) in the maxillary left first and second molar became essential to increase the vertical dimension in this side, thereby allowing the left premolars extrusion in Class I relationship (Figs 7 and 8). Also, for this extrusion, MEAW activation was important to apply a different orthodontic force on both sides. The use of intermaxillary elastics as an additional orthodontic force device was indispensable.
In principle, the use of midline elastics for midline alignment is not advisable. The midline elastic with compensation of its vertical vector could aggravate the left and right tipping of the occlusal plane. As a result, the left and right side tipping of the occlusal plane will worsen, even if the positive effect is achieved on the alignment of the maxillary and mandibular midline.

The customary masticating side is usually the displaced side. There is lateral displacement of the chin as shown in the frontal view in intercuspal position and when the patient opens the mouth, but in mandibular protrusion, the chin and dental midlines became centered, which is due to the fact that the articular disk of the affected side was probably anteriorly displaced in intercuspal position and recuperated its normal position in protrusion (Fig 2). Moreover, case histories show that mandibular lateral displacement induces the subluxation of the nondisplaced side of the condyle from the glenoid fossa. So orthodontists should realize that midline discrepancy is one of the symptoms of mandibular lateral displacement and that the major objective of the orthodontic correction of this malocclusion should be focused on the elimination of posterior discrepancy and the differential control of occlusal plane. Therefore, by increasing the occlusal vertical height of the shifted or affected side, well-balanced muscles and articular disk positions were restored.5

Thanks to the correction of an early functional impediment in a young adult by changing the position of the occlusal plane, the balance among the maxillofacial structures can be achieved and a stable dental articulation, and optimal esthetic and functional results can be obtained.

REFERENCES