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Non-surgical Treatment of an Adult Class III Malocclusion Patient with Facial Asymmetry by Unilateral Mandibular Arch Distalization

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INTRODUCTION

The skeletal Class III inter-jaw relation describes craniofacial anomaly involving sagittal jawbone discrepancies between the maxilla and mandible, and usually characterized with disharmonious concave facial profile. The incidence of Class III malocclusion varies by different races, with a higher prevalence among the Asian population (15% - 23%) and lower prevalence among Caucasian descent (< 5%). The components of Class III deformities included maxillary retrognathism, mandibular prognathism, or a combination of both. The growth maturity plays a major role in the treatment of patients with Class III malocclusion. Orthopedic appliances are commonly used to treat young patients or adolescents with great growth potential, and early diagnosis and intervention contribute to improvements of skeletal discrepancies by growth modification. However,
for those adult patients, the treatment strategies restrict to either orthodontic teeth movement alone, or combine surgical orthodontic treatment.  

The dento-alveolar compensations of specific patients characterized with skeletal Class III jaw relation but acceptable profiles have been extensively utilized in treating those patients don’t accept orthognathic surgery. The camouflage treatment usually includes compensated incisor movements within the boundary limitations of underlying jawbones to improve the dental occlusion. The extraction of mandibular teeth to provide space for retraction of lower anterior teeth is a common treatment strategy. On the contrary, the alternative involves whole mandibular dental arch distalization without sacrificing any natural teeth. Clinicians should consider these treatment options based on meticulous clinical examination, and evaluate the adverse effects during the orthodontic treatment.

**DIAGNOSIS AND ETIOLOGY**

One 22-year-old healthy male patient presented with a chief complaint of “reversed occlusion and chin prominence”, an extra-oral examination revealed skeletal Class III jaw relationship with prognathic mandible and normal developed maxilla. The patient also exhibited the mandibular deviation toward right side for 2 mm, no lip incompetence, gummy smile or canting occlusal plane were observed (Figure 1, 3).

The intraoral examination revealed dental Class III malocclusion with both anterior and posterior crossbite, the original overjet was -2.5 mm, and overbite was 3 mm, patient had 2 mm and 0.5 mm space distal to the lower left and right canines, respectively, the lower dental midline deviated to the right by 2 mm relative to facial midline at patient’s centric occlusal position (Figure 2).

During the functional examination, patient demonstrated anterior functional shift of the mandible resulted from the premature contact of the incisors (Figure 2), the edge-to-edge incisor relationship could be achieved and mentioned. Despites the improvement of the sagittal jaw discrepancies, the mandibular right side deviation still presented in the centric relation (CR) position.

**TREATMENT OBJECTIVE**

Clinician’s treatment objectives were to establish proper overjet and overbite, to eliminate the mandibular functional shift, to correct dental midline discrepancies, to achieve bilateral Class I molar and canine relationship.
Figure 2. Initial intraoral photographs and functional examination. (edge-to-edge incisal relationship).

Figure 3. Pretreatment panoramic and cephalometric radiographs.
TREATMENT PLAN

After discussion of all possible treatment alternatives, the camouflage treatment plan set up as:

1. Full mouth orthodontic treatment without orthognathic surgery
2. Extraction bilateral lower third molars
3. Unilateral miniscrew inserted over left mandibular buccal shelf
4. Close all the remaining space
5. Retention with fixed retainer and bimaxillary Hawley retainer

TREATMENT ALTERNATIVES

1. Orthodontic camouflage treatment by extraction of mandibular first premolars and maxillary second premolars for anterior retraction.
2. Orthodontic treatment combined with two-jaw orthognathic surgery for correction of mandibular prognathism and facial asymmetry.

TREATMENT PROGRESS

The orthodontic treatment initiated after extraction of bilateral lower third molars. The self-ligating brackets (0.022 slot Damon® system) were used for treatment. The initial leveling was performed with 0.014-inch nitinol wires, followed by 0.014x0.025-inch CuNiTi wire, and 0.018-inch nitinol wires for alignment. After 4 months, the miniscrew (2.0 mm in diameter; Bio-Ray, Syntec Scientific Corp., Taipei, Taiwan) was placed in the left mandibular buccal shelf. The unilateral mandibular arch distalization were performed over a 0.018x0.025-inch stainless-steel archwire. The miniscrew initially provided indirect anchorage to close the excessive space mesial to mandibular left first premolar. Positive overjet was achieved at the 3rd month after initiation of miniscrew-facilitated mechanism. The long power arm was then used for the succeeding unilateral distalization (Figure 4) and protraction of right side mandibular dentition. In the 26th month, all the residual space was closed and dental midline became coincident. The bilateral Class III elastics were used for improvement of molar relationship followed by finishing procedures. After 32 months of orthodontic treatment, the bands and braces were removed. The 0.0175-inch tripleflex wire were bonded from canine to canine in the upper jaw, meanwhile the fixed bonded wire extended between the first premolars in the lower arch.

Figure 4. Miniscrew facilitated correction of skewed mandibular dental arch.
TREATMENT RESULT

The negative overjet was successfully corrected by non-surgical camouflage orthodontic treatment (-2.5 mm to +2.5 mm) with the aid of miniscrew and Class III elastics. The original incisal interference was eliminated and the functional shift of the mandible was no longer observed, patient’s chin became less prominent (Figure 5). Proper alignment and bilateral Class I molar and canine relationship were achieved. The post-treatment cephalometric analysis showed the improvement of the skeletal relationship. The proclination of upper incisors and retroclination of lower incisors were noted as expectation as the results of camouflaged approach (Figure 6, 7). The superimposition revealed 3 mm extrusion of maxillary molars which result from the usage of Class III elastics (Figure 8). To be addressed, the total distal movement of mandibular left first molar was 7 mm, which would be contributed by the recovery from functional shift and 3 mm unilateral distalization, mostly with bodily movement.

Figure 5. Posttreatment extraoral photograph.

Figure 6. Posttreatment intraoral photograph.
Table 1. Patient's cephalometric analysis

<table>
<thead>
<tr>
<th></th>
<th>Norm</th>
<th>Pre-Tx</th>
<th>Post-Tx</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skeletal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNA</td>
<td>82.9° ± 3.4</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>SNB</td>
<td>79.8° ± 3.1</td>
<td>93</td>
<td>90.5</td>
</tr>
<tr>
<td>ANB</td>
<td>3.1° ± 2.1</td>
<td>-4</td>
<td>-1.5</td>
</tr>
<tr>
<td>SN-MP</td>
<td>32.0° ± 4.6</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Wits Appraisal</td>
<td>-1.1 ± 2.3</td>
<td>-13.5</td>
<td>-5</td>
</tr>
<tr>
<td>Mx Length</td>
<td>93.6 ± 3.2</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Md Length</td>
<td>121.6 ± 4.5</td>
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<td>147</td>
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<tr>
<td>ALFH/ATFH</td>
<td>55 ± 2 %</td>
<td>59.5%</td>
<td>60.4%</td>
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<td>PFH/TFH</td>
<td>62-65%</td>
<td>71.6%</td>
<td>70.8%</td>
</tr>
<tr>
<td><strong>Dental</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>U1-SN</td>
<td>107° ± 6.0</td>
<td>109</td>
<td>117</td>
</tr>
<tr>
<td>U6-PP (mm)</td>
<td>22.5 ± 1.5</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>L1-MP</td>
<td>98.1° ± 5.2</td>
<td>83</td>
<td>79</td>
</tr>
<tr>
<td>L1-NB (mm)</td>
<td>6.0 ± 1.9</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>U1-L1</td>
<td>135.4° ± 5.8</td>
<td>140</td>
<td>137</td>
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<tr>
<td><strong>Soft tissue</strong></td>
<td></td>
<td></td>
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<tr>
<td>U lip to E-line</td>
<td>1.4 ± 2.1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>L lip to E-line</td>
<td>3.1 ± 2.3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Nasolabial angle</td>
<td>102° ± 8</td>
<td>87</td>
<td>85</td>
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<tr>
<td>H angle</td>
<td>7-15°</td>
<td>10</td>
<td>8.5</td>
</tr>
</tbody>
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Figure 7. Posttreatment panoramic and cephalometric radiographs.

Figure 8. Pretreatment and posttreatment superimposition.
Black line, before treatment; red line, after treatment.

Tsai CY, Lin SS, Lee YH, Sun LT, Chang YJ, Wu TJ
DISCUSSION

The strategies to treat adult Class III malocclusion patients usually involving either a combination of surgical orthodontic treatment or dento-alveolar compensation by orthodontic tooth movement alone. For critical cases, the differences should be the key points of all treatment plans, several clinical guidelines were proposed, Kerr suggested that the threshold values of orthognathic treatment for angle ANB and lower incisal inclination were -4 and 83 degrees, respectively. In addition, the critical measurements with maxillary or mandibular (M/M) ratio of 0.84 and Holdaway angle of 3.5° should also be considered for surgery. Stellzig-Eisenhauer developed a formula by stepwise discriminant analysis and claimed that Wits appraisal, anterior cranial base length, M/M ratio, and lower gonial angle were variables to determine the critical score between surgical and non-surgical orthodontics. Tseng used receiver operating characteristic (ROC) analysis and illustrated that if a Class III malocclusion patient meet at least 4 of 6 criteria (overjet ≤ -4.73 mm; Wits appraisal ≤ -11.18 mm; L1-MP angle ≤ 80.8°; Mx/Mn ration ≤ 65.9%; overbite ≤ -0.18 mm; and gonial angle ≥ 120.8°), then the patient would be recommended to have surgical treatment. Despite surgical correction might be indicated by cephalometric analysis and recommended by dental specialists, self-perceptions of profile could have more affect to the patient's decision. In this case, patient was considered as a critical surgical or orthodontic case with facial asymmetry (ANB: -4°, L1-MP angle: 83°, Mx/Mn ratio: 65.9%, Wits appraisal: -13.5 mm, gonial angle: 120°). However, patient deemed the OGS to be invasive, uncomfortable and increased expenses, and therefore opted to receive orthodontic camouflage.

Clinically, the clinicians make diagnosis and prepare treatment plan based on the standardized intra-oral and extra-oral photographs, frontal and lateral cephalograms, panoramic and temporomandibular (TMJ) X-ray film, and dental casts. However, the dynamic change of the mandible position from habitual protruded position to the retruded position, or functional shift of the mandible, is easily ignored. Therefore, the diagnosis made from the occlusion of the dental cast or photos may be totally different from the diagnosis made after the position of the lower jaw was correctly determined, and consequently result in inadequate treatment planning. The current case demonstrated CO-CR discrepancy, the interference from labial surface of maxillary incisors made the mandible function shift forward, thus worsen the negative overjet and masked the true CR position. The elimination of incisal interference revealed edge-to-edge relationship and retruded mandible position, which made the dental camouflage of Class III malocclusion possible.

The dento-alveolar camouflage treatment for skeletal Class III malocclusion patients are usually presented with proclination of upper incisors and retroclination of lower incisors. The treatment modalities include selective tooth extraction (premolars, lower incisors, or lower second molars), the use of the MEAW technique and temporary anchorage devices to distalize the entire mandible dentition. There are few factors should be taken into consideration and inform patient before determining the treatment plan. Dental extraction of lower premolars usually involve large amount of lower incisors retraction to improve the overjet. However, the incisors should not be moved beyond the envelope of discrepancy, or boundary limitations. In addition, patient’s chin may appear more protrusive, and subsequently result in unaesthetic outcome. Moreover, the only extraction in mandibular premolars lead to “full unit Class III molar relationship,” with the upper second molar having no occlusal contact and consequently overeruption. The MEAW technique contains multiple L-loops and tip back bends that could be able to upright posterior teeth, to change the occlusal plane inclination, and to correct the sagittal relationship with the use of intermaxillary elastics, but the effective distal movement of the
mandibular dentition in response to MEAW approach highly depends on patient’s cooperation. In addition, Jing also reported a case with remarkable proclined maxillary incisors when combined with short Class III elastics, and consequently compromised the pleasing smile. Miniscrews applied vertically in the external oblique ridge areas of the mandibular ramus could be served as skeletal anchorage for distalization of the mandibular dentition. The introduction of miniscrews has increased the reliability of results because of decreasing requirements of patient’s compliance, minimizing the side effects of using intermaxillary elastics and reducing the situation of dental extractions to retract anterior teeth to a great extent.

In this case, the jaw discrepancies became less severe after eliminating the mandibular functional shift, which allowed clinicians to perform non-extraction treatment instead of large amount of retraction. The miniscrew was prepared for enhancing posterior anchorage and midline correction. Besides, in conjunction with the self-ligation system, the lower frictional resistance might also contribute to the effective distalization of mandibular teeth, and positive overjet was obtained with the aid of the miniscrew and Class III elastics. The clockwise mandible reposition and the increase of anterior lower facial height would be factors contributed to successful camouflage the prognathic mandible and to obtain satisfying profile.

The gingival black triangles and labial root prominence in anterior mandible were presented, this might be caused from the reduction in alveolar bone width at the coronal level and pronounce labial movement of the roots. This patient should be followed for periodontal health after camouflage treatment. Xiong demonstrated the relapse of lower incisors toward labial movement in the camouflage patient for 3 years long-term follow-up. Besides the fact that the mandibular anterior alignment is prone to relapse toward the original position, the reduction in tongue space after arch distalization may result in extreme tongue pressure exerted on the lower incisors. For retention, lingual fixed retainers were bonded on the upper and lower anterior teeth, and this patient was advised to practice a tongue posture to contact the palatal surface. Since the risk of occlusal interference by overeruption maxillary third molars may cause anterior functional shift of the mandible, extraction of those teeth were strongly recommended. Despite this patient was informed about the risk, patient still refused to extract upper third molars. Therefore, it is critical to closely observe the occlusal stability. One-year-follow-up record showed there is no more anterior and lateral functional shift of the mandible. The occlusion was stable without CO-CR discrepancy and the mandibular incisor alignment was also maintained well.

**CONCLUSION**

Several orthodontic camouflage treatment modalities could be used to treat mild Skeletal Class III patients with high performance, provided by appropriate initial examination and diagnosis. In this case, clinicians detected CO-CR discrepancy during functional examination, which prompted clinicians to review the feasibility of original treatment plan. More importantly, the benefits and disadvantages, and the limitations of camouflage treatment should be explained carefully to patient before the beginning of treatments.

**REFERENCE**


