Skeletal Class III Malocclusion with Canine Transposition and Facial Asymmetry

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History and Etiology
A 13-year-6-month-old male presented with a chief complaint of prognathic mandible (Figs. 1-3). There was no other contributory medical or dental history. The etiology was hereditary tendency for prognathic mandible with eruption of the maxillary central incisors into crossbite, which resulted in a functional shift of 4mm anterior and 3mm to the left. Clinical exam indicated transposition of the permanent right maxillary canine and premolar, general crowding and anterior crossbite (Fig. 2). Extraction of all four first premolars was proposed to correct the canines and premolars, as well as anterior segment (Fig. 3). Anterior crossbite was corrected in the initial stage of treatment to assist crossbite correction. Early light short Class III elastics were used in the initial stage of treatment to assist crossbite correction (Fig. 11).

After the crossbite correction and alignment of the maxillary anterior segment, a torquing auxiliary was indicated for the maxillary right canine. A mandibular pre-torqued rectangular NiTi wire was used in the initial stage of treatment to assist crossbite correction. Early light short Class III elastics were used in the initial stage of treatment to assist crossbite correction (Fig. 11). After the crossbite correction and alignment of the maxillary anterior segment, a torquing auxiliary was indicated for the maxillary right canine. A mandibular pre-torqued rectangular NiTi wire was used in the initial stage of treatment to assist crossbite correction. Early light short Class III elastics were used in the initial stage of treatment to assist crossbite correction (Fig. 11).

Specific Objectives of Treatment

Maxilla (all three planes):
- A - P: Maintain
- Vertical: Maintain
- Transverse: Expand to coordinate with lower arch

Mandible (all three planes):
- A - P: Maintain
- Vertical: Extrusion with increased vertical dimension of occlusion
- Inter-molar / Inter-canine Width: Maintain

Facial Esthetics:
- Posterior movement of chin point and lower lip

Treatment Plan
All four first premolars were extracted to create space to align the transposed right maxillary canine, as well as to retraction the protruded lower anterior segment, to correct the crossbite (Fig. 11). Anterior bite turans were bonded on the lingual surfaces of the mandibular central incisors and the left lateral incisor to open the bite for crossbite correction. Early light short Class III elastics were used in the initial stage of treatment to assist crossbite correction (Fig. 11).

Diagnosis
In centric occlusion, a severe dental asymmetry was noted. Class III molar on the right side, Class I molar on the left side, and an intermaxillary midline discrepancy of ~7mm. There was a concave profile and asymmetrical facial form with the mandible deviated to the left. Relative to the facial midline, the lower dental midline was 5 mm to the left. The anterior crossbite extended from the right lateral incisor to the left 2nd premolar. Cephalometric and panoramic radiographs (Fig. 7), as well as anterior segment photographs (Fig. 10) document the complexity of the malocclusion.

Skeletal:
- Mandibular plane angle (SN-MP 37°, ANB -5°)
- SNB 75°
- SNA 70°
- Class III on the right and Class I molar relationship on the left
- Class III elastics were used in the initial stage of treatment to assist crossbite correction. Early light short Class III elastics were used in the initial stage of treatment to assist crossbite correction (Fig. 11).

Mandible (all three planes):
- A - P: Maintain
- Vertical: Extrusion with increased vertical dimension of occlusion
- Inter-molar / Inter-canine Width: Maintain

The ABO Discrepancy Index (DI) was 46 points as shown in the subsequent worksheet.
Retention

Fixed retainers were bonded on all maxillary incisors and from second premolar to second premolar in the mandibular arch. An upper clear over- retainer was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. Instructions in home care and maintenance of retainers were provided.

Final evaluation of treatment

The ABO Cast-Radiographs Evaluation score was 23 points. The major discrepancies were in the lingual occlusal contacts and alignment/rotation. Deviation of the lower dental midline was decreased to 1 mm to the left of the maxillary midline. The transposed canine was well aligned, and the gingiva texture was reasonably healthy (Fig. 5).

Collectively, molar extrusion and mandible clockwise rotation improved the Class III molar relationship. Corrected. Overall, this Class III asymmetric malocclusion was treated to an appropriate facial and dental result. The roots of the maxillary incisors were out of focus on the post-treatment panoramic radiograph, but it appears that there was significant root resorption of both maxillary central incisors and the left lateral incisor. The latter may have been due to the occlusal stress of the premature contact with the anterior bite during crossbite correction.

Discussion

Surgical correction is routinely indicated for asymmetrical Class III malocclusions because of a questionable prognosis for orthodontics only management of large skeletal discrepancies and satisfactory esthetic outcomes. However, if there is a substantial functional shift, the asymmetrical profile and mandibular molar relationship are accentuated. Increasing lower facial height and correcting the functional shift are more readily achieved with nonsurgical treatment. Facial profile in this case, the pros and cons of conventional and surgical treatment are important elements of diagnosis and treatment planning.

Growth potential warrants additional consideration if a patient exhibits signs of mandibular overgrowth. In the present case, although the mandibular prognathism was noted at the beginning of treatment, little or no further increase in mandibular length was noted during treatment. Baccetti provided an assessment method for determining skeletal maturation by evaluating the cervical vertebrae in routine lateral orthopanographs. For the present case, skeletal maturation exceeded C5-6, indicating a mature skeletal pattern, suitable for treatment as an adult. There were additional indications favoring non-surgical orthodontic options: 1) the chief complaint was primarily aesthetic, and the patient was interested in crossbite correction.

A conservative treatment approach was selected which consisted of a camouflage dental correction (Fig. 17) with counter-clockwise rotation of occlusal plane. Downward and backward rotation of the chin point, in conjunction with molar extrusion and increased lower facial height, produced a more harmonious lateral facial profile. Predominant dental...
changes included proclamation of the maxillary incisors and retroclination of the mandibular incisors. Torque control was essential in camouflage treatment in order to prevent further periodontal problems. Loss control of anterior teeth might compromise long-term stability, particularly in extraction cases. Early usage of ARTs and the pretooned NITI wire on the lower arch delivered a continuous light force as opposed to a heavy interrupted force from a twist-cut rectangular wire at a later stage in treatment. As the transposed right maxillary canine was moved mesially, an ART spring was used to correct the axial inclination (Fig. 18).

Higher torque canine brackets would have been more favorable for the present case (Fig. 12). Anterior or posterior placement of bite turbos can be used for bite opening. For the present patient, molar extrusion and clockwise rotation of the mandible were part of the treatment plan, so anterior bite turbos were appropriate for this purpose. With bite turbos and early light short elastics (Class III vector), the anterior crossbite was corrected within seven months. Short Class III elastics on the right side also provided an extrusion for the infra-occlusion right mandibular canine and redirected the displaced maxillary bone to return to its normal position. This approach would not be appropriate for patients with a true severe skeletal asymmetry and large discrepancy in ramus height. Carefully monitoring of the treatment response is critical for success. For instance, initial occlusal shift due to anterior bite turbos may contribute to the root resorption of the maxillary incisors in some patients. A progress radiograph six months into treatment would have been appropriate because the root of the left maxillary central incisor appears to be moderately resorbed prior to treatment (Fig. 7). Fortunately, the panoramic radiograph at the end of treatment showed no significant progression of maxillary incisor root resorption (Fig. 8).

Temporary anchorage devices (TADs), placed lateral to the alveolar processes (mandibular buccal shelves, infrazygomatic crests) are a break through for treatment of Class III malocclusions. The stationary anchorage of TADs facilitate retraction of the entire lower arch without proclamation (anterior tipping) of maxillary incisors or deterioration of smile arc; two common problems with Class III elastics (Fig. 19). For many Asians, the major contributory factor for Class III malocclusion is mandibular prognathism with normal mid-face development.

TADs provide reliable anchorage for Class III treatment without creating the undesirable effects seen with intermaxillary elastics. For the present patient, the application of TADs was considered, but discarded because of the acceptable upper lip prominence (Fig. 20) and the transposition of the maxillary right canine and first premolar. Nonextraction treatment of the transposition with TAD anchorage would have been very difficult. Since extraction of the maxillary left first premolar was necessary, the most expedient approach was to remove all four first premolars, and treat the patient with conventional mechanics.

As mentioned previously, smile arc preservation is crucial for an esthetic result with Class III cases. Ackerman reported that 40% of root orthodontics corrections show a deterioration in smile arc. The nature of Class III mechanics include molar extrusion, counter clockwise rotation of the occlusal plane (Fig. 17), and torque change in incisors of both arches. These side effects further challenge smile arc preservation during Class III (Fig. 19) treatment. Restrictive usage of Class III elastics, in combination with Class II elastics and TADs in the mandible, can effectively enhance the smile arc. However, the biomechanical boundary remains definitive, regardless of the treatment methods. As proposed by Kondo, the anterior limit for incisor retraction is the posterior border of the symphysis, and the PM or ramus line is the posterior limit for arch retraction (Fig. 23).

Asymmetrical correction is complex, and often involves various mechanisms, including intra-arch auxiliaries and multiple loops, for realigning and coordinating the arcs. These special mechanics are often associated with undesirable side effects like compromised molar angulation to meet occlusal goals at the end of treatment. Low friction, self-ligating brackets with special elastics configurations simplify this challenge significantly. Although the green mandible deviation, that was evident after correction of the functional shift, was not completely corrected for the present patient, but the result was satisfactory. The CRE score was 22, with most of the points deducted for inadequate third order correction of the maxillary posterior segments, which is reflected in the scores for buccolingual inclination (4 points) and lingual cusp contacts (3 points). More buccal root torque in the maxillary buccal segments and additional detailing with wire bending in the finishing stage would have improved the final result.

Conclusion
Skeletal Class III treatment with camouflage orthodontics presents significant clinical challenges. The treatment is further complicated with Asian patients who present with hereditary etiology and severe crowding. Orthopedic treatment with rapid maxillary expansion, a facemask or a chinup show varying degrees of success, due to different protocols and case selection. With the help of self ligating brackets, bite turbos, and a properly designed force system, clinicians can now deliver relatively efficient extraction treatment that achieves a satisfactory result. However, the progress of treatment should be carefully monitored to control potential complications.

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References

The complete list of references available from the publisher.

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