Skeletal Class III Malocclusion with Canine Transposition and Facial Asymmetry

By Dr. Wei Ming-Wei, Dr. Chris Chang, Singapore & Dr. W. Eugene Roberts, NZ

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 canine transposition and create space to align the transposed with the adjacent 1st premolar.

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

Specific Objectives of Treatment
Maxilla (all three planes):
- A - P: Maintain
- Vertical: Maintain
- Transverse: Expand to coordinate upper arch

Mandible (all three planes):
- A - P: Maintain
- Vertical: Extrusion of molars
- Inter-molar / Inter-canine Width: Maintain

Maxillary Dentition:
- Inter-molar Width: Maintain
- Vertical: posterior rotation to open bite
- A - P: Maintain

Mandibular Dentition:
- A - P: Retraction of anterior teeth
- 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 retract the protruded lower anterior segment, to correct the crossbite (Fig. 11). Anterior bite turbos 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. 12).

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, with vertical elastics were used to flatten and align the arch (Fig. 13). A mandibular anterior torqueing auxiliary and asymmetric intermaxillary elastics (Class III right, variable torques for upper 3-3 brackets.

Offering the same crystal clear performance with more control, Damon Clear2 allows you to treat a wide variety of cases with outstanding results so your practice and your patients can put their best face forward.


Order your Damon Clear2 brackets today! Visit ormcoeurope.com

the lower incisors were noticed. Well controlled torque of incisors were found in this extraction case.

![Fig 9. Superimposed tracings. Reasonable](image)

A 0.022" Damon Q® bracket system was used. The maxillary arch was bonded with standard torque brackets, and low torque brackets were selected for the lower anterior teeth to counter the force of Class III elastics (Fig. 12). After seven months of active treatment, the right maxillary canine was aligned into the arch. Positive overjet was achieved and the canting of the lower occlusal plane (Fig. 10) was improved. Anterior root torque springs (ART) were placed on both the lower anterior teeth and right maxillary canine for early torque control (Figs. 12-14). After eleven months of active treatment, maxillary space was closed, but the excessive Curve of Spee of the lower arch and the mandibular deviation were still evident. Clockwise rotation of the mandible corrected the severe Class III relationship on the right side to Class I, but the slight Class III on the left evolved into a Class II molar relationship. A 0.019 x 0.025 pre-torqued NiTi wire with asymmetrical elastics were used to flatten the Curve of Spee and correct the molar relationship in this stage of treatment (Fig. 14).

From the 12-20 months of treatment, a Class III Leupe elastic from the right mandibular canine, and courting under the 2nd premolar bracket to the right maxillary 1st molar was used for space closure and settling of the posterior occlusion (Fig. 15). Seven months were required to correct the asymmetric molar relationships. In the last two months of treatment, elastics were applied to settle the occlusion upside down U shape elastics in the anterior and a vertical elastic in the second molar area bilaterally were applied to settle the final occlusion (Fig. 16). After 29 months of active treatment, all appliances were removed.

**Results achieved**

Maxilla (all three planes):
- **Vertical:** Maintained
- **Transverse:** Maintained

Mandible (all three planes):
- **A-P:** Maintained
- **Vertical:** Mild clockwise rotation to increase the vertical dimension
- **Transverse:** Maintained

**Retention**

Fixed retainers were bonded on all maxillary incisors and from second premolar to second premolar in the mandibular arch. An upper clear overlay 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-Radiographic Evaluation score was 25 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. Collectively, molar extrusion and mandible clockwise rotation improved the asymmetric molar relationship. Correction of Class III molar relation was corrected. Overall, this Class III asymmetric malocclusion was treated to an appropriate Class III molar relation.

**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 unsatisfactory esthetic outcomes. However, if there is a substantial functional shift, the asymmetrical profile and mandibular molar relation are accentuated. Increasing lower facial height and correcting the functional shift are more readily achieved with nonsurgical treatment. Facial profile. 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. Reciprocally provided an assessment method for determining skeletal maturation by evaluating the cervical vertebrae in routine lateral cephalograms. For the present case, skeletal maturation exceeded CS 5, indicating a mature skeletal pattern, suitable for treatment as an adult. There were additional indications favoring nonsurgical orthodontic options: 1) the chief compliant was mandibular protraction with consideration of facial asymmetry; 2) reduced lower facial height (angle nasolabial angle 4); negative overjet less than 4 mm, and 3) a moderate Class III molar relationship with a discrepancy that was less than a millimeter's width. 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. Predictable dental...
changes included proclination of the maxillary incisors and retroclination of the mandibular incisors. Torque control was essential in camouflaging 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 twisted 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 inappropriate 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 force for the infra-occlusion right maxillary canine and redirected the displaced mandible 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 stress 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 incisal root resorption (Fig. 8).

Temporary anchorage devices (TADs), placed lateral to the alveolar processes (mandibular buccal shelves, infraymognathic crests) are a break through for treatment of Class III malocclusions.10 The stationary anchorage of TADs facilitate retraction of the entire lower arch without proclination (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 or 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 routine orthodontics corrections show a deterioration in smile arc.11 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.12 As proposed by Kondo,13 the anterior limit for incisor retraction is the posterior border of the symphysis, 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 arches. These special mechanics are often associated with undesirable side effects like compromised molar angulation to meet occlusal goals at the end of treatment.14 Low fiction, selfligating brackets with special elastics configurations simplify this challenge significantly. Although the norm is midsagittal 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.15

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 chin cup show varying degrees of success, due to different protocols and case selection.16 With the help of self ligating brackets, bite turbox, 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.

Acknowledgment
Thanks to Mr. Tzu Han Huang for proofreading this article.

References

The complete list of references available from the publisher.

Reprinted with permission from International Journal of Orthodontics and Implantology.
Tomas® TAD Event
Abu Dhabi, UAE | September 30 – October 1, 2016

Discover new TAD-based solutions utilizing both indirect and direct anchorage mechanics

By New Al Farwaniya

TOMAS® (Temporary Orthodontic Micro Anchorage System)
The tomas® system has been one of the leading skeletal anchorage systems for many years. Users value its easy, clearly structured handling and high reliability. It is distinguished, mesialization, intrusion, palatal expansion or indirect anchorage. tomas® offers a complete system for all of these indications. Discover new TAD-based solutions utilizing both indirect and direct anchorage mechanics. Experience the evolution of TAD-supported aligner therapy including new TAD design and auxiliaries. Introduce your practice to a revolutionary new TAD-based advanced molar distalizing appliance.

Seminars program consist of the following:

Evidence based temporary orthodontic micro anchorage & the tomas® concept
Orthodontic mini-screws for temporary anchorage have become enormously popular as a clinical option for the practitioner. However, published evidence-based data is still rare, although numerous systems and clinical reports are available. The objective of this seminar is to present the fundamentals of the mini-screw concept, submit an overview of available mini-screw systems, describe the mini screw system “tomas®”, which has been clinically tested and extensively applied in daily practice for more than 6 years, demonstrate the pin placement procedure, provide specific data about indications, mechanics, screw failure rates, and address 3D control of tooth movements.

tomas® TAD Event has been successfully organized by New Al Farwaniya Surgicals & Medical Equipment, Abu Dhabi with the immense participation of Dentaurum, Germany.

For more information, kindly visit www.dentaurum.com/tad2016 or contact our Sales Team - Dr. Muhammad Bashar Alkassab: m.bashar@alfarwaniya.com