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-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 4 mm anterior and 3 mm 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 for retraction of lower anterior dentition. The patient was treated in an acceptable result as documented in Figs. 4-9.

Fig 1. Pre-treatment facial photographs

Fig 2. Pre-treatment intraoral photographs

Fig 3. Pre-treatment study models (casts)

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 malocclusion discrepancy of -7 mm. There was a concave profile and asymmetrical facial form with the mandible deviated to the left. Relative to the facial midline, the upper dental midline was 5 mm to the right, while the lower dental midline was 9 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:
- Maxilla: Class III (SNA 70°, SNB 75°, ANB -5°)
- Mandible (all three planes):
  - ANB: 0° (Fig. 9)
  - Mandibular plane angle (SN-MP 37°, FMA 29°)
  - Mandible (all three planes):
    - ANB: 0° (Fig. 9)

Facial Esthetics:
- Posterior movement of chin point
- Vertical: extrusion with increased vertical dimension of occlusion

Dental:
- Class III on the right and Class I molar relationship on the left
- Maximum overbite 3 mm
- Maximum overjet -3 mm

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: Maintenance
- Transverse: Expansion of molars
- Inter-molar Width: Maintain

Mandibular Dentition:
- A - P: Retraction of anterior teeth
- Vertical: Extrusion with increased vertical dimension of occlusion
- Inter-canine / Inter-molar Width: Maintain

Treatment Plan
All four 1st 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. 10). Anterior bite tubes 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).

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. 12). A mandibular anterior torquing auxiliary and asymmetric intermaxillary elastics (Class III right, Class I left) were indicated to improve the mandibular molar relationship and anterior crossbite. 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. 12). A mandibular anterior torquing auxiliary and asymmetric intermaxillary elastics (Class III right, Class I left) were indicated to improve the mandibular molar relationship and anterior crossbite.

**As compared to Damon Clear upper 3-3 brackets.

*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, keeping your patients’ best face forward.

NEW! DAMON CLEAR2 Variable Torques

100% CLEAR BRACKET BODY AND SLIDE: for the supreme aesthetics, patients demand SMOOTH, ROUNDED CORNERS for outstanding patient comfort

INNOVATIVE SPINTEK™ SLIDE: for easy and comfortable wire changes

NEW! DAMON CLEAR2 Variable Torques

100% CLEAR BRACKET BODY AND SLIDE: for the supreme aesthetics, patients demand SMOOTH, ROUNDED CORNERS for outstanding patient comfort

INNOVATIVE SPINTEK™ SLIDE: for easy and comfortable wire changes

FOUR SOLID WALLS with improved precision slot for 2x the rotational control™ for meticulous finishing and efficient treatment

Order your Damon Clear2 brackets today! Visit ormcoeurope.com

© 2016 Ormco Corporation

© 2016 Ormco Europe
Overjet correction due to maxillary incisors were found in this extraction case.

Fig 9. Superimposed tracings. Reasonable overjet was also achieved. Positive overjet was achieved. of right maxillary canine and the lower-

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 shift are accentuated. Increasing lower facial height and correcting the functional shift are more readily achieved with nonsurgical treatment. By evaluating the cervical vertebrae in routine lateral cephalograms, 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. The present case, although the mandibular prognathism was not at the beginning of treatment, little or no further increase in mandibular length was noted during treatment. 

A conservative treatment approach was selected which consisted of a camouflage dental correction (Fig. 17) with counter-clockwise rotation of the occlusal plane. A-P: Flaring of the incisors Vertical. Molar extrusion and mesial movement Inter-molar / Inter-canine Width: Maintained

Retention

Fixed retainers were bonded on all maxillary incisors and from second premolar to second premolar in the mandibular arch. An upper clear overjet 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.

Fig 7. Premolars were extracted in the initial treatment. Anterior bite turbines were boned on the lower arch for bite opening.

Fig 5. Post-treatment intraoral photographs.

Appliance and treatment progress

A 0.022” Damon QUAD bracket system (Ormco) 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. 4).

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 (Fig. 9). Anterior root torque springs (ART) were placed on both the lower anterior teeth and right maxillary canine for early torque control (Figs. 11-14). After eleven months of active treatment, maxillary space was closed, but the excessive Curve of Spee of the lower arch and the midline deviation were still evident. Clockwise rotation of the mandible corrected. Overjet was improved. Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved.

Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved. 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 turbines during crossbite correction.

Class II left) were applied (Figs. 14–15). Vertical elastics were used to pro-

Fig 8. Post-treatment panoramic and cephalometric radiographs.

Table 1: Cephalometric summary

Appliance and treatment progress

A 0.022” Damon QUAD bracket system (Ormco) 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. 4).

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 (Fig. 9). Anterior root torque springs (ART) were placed on both the lower anterior teeth and right maxillary canine for early torque control (Figs. 11-14). After eleven months of active treatment, maxillary space was closed, but the excessive Curve of Spee of the lower arch and the midline deviation were still evident. Clockwise rotation of the mandible corrected. Overjet was improved. Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved. 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 turbines during crossbite correction.

Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved. 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 turbines during crossbite correction.

Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved. 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 turbines during crossbite correction.

Collectively, molar extrusion and mandible clockwise rotation improved Class III molar relation. Overjet correction was achieved. 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 turbines during crossbite correction.
changes included proclination 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 ARFs and the preloaded NTD 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 extension 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 force for the infra-occlusion right mandibular 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, infrayyagmatic crests) are a break through for treatment of Class III malocclusions. 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 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 recent orthodontic corrections show a deterioration in smile arc.23 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.23 However, the biomechanical boundary remains definitive, regardless of the treatment methods. As proposed by Kondo,7 the anterior limit for incisor retraction is the posterior border of the symphysis, whereas the PM or ramus line is the posterior limit for arch retraction (Fig. 21).

Asymmetrical correction is complex, and often involves various mechanics, including intra-arch auxiliaries and multiple loops, for realigning and coordinating the arches.2,3 These special mechanics are often associated with undesirable side effects like compromised molar angulation to meet occlusal goals at the end of treatment.2 Low friction, selfligating brackets with special elastics configurations simplify this challenge significantly. Although the green small dimension, 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.24

Ortho Specialists

Fig. 18. Early torque control with right maxillary canine contributed good torque expression in the middle of treatment (Arrow: root torque spring).

Fig. 19. Flattening of smile arc after Class III correction is a common side effect in traditional orthodontic mechanics.

Fig. 20. An acceptable upper lip profile without TADs anchorage.

Fig. 21. Anterior and posterior boundary of the arch distalization in the mandible.

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 chincap show varying degrees of success, due to different protocols and case selection.20 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.

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 I 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 for its stabilization, 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 3-D 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. Mohammad Bashar Alkassab: m.bashar@alfarwaniya.com

Dr. Sebastian Baumgaertel I Cleveland, OH, USA, has lectured worldwide on various orthodontic topics including orthodontic mini-implants and cone beam computed tomography. He has published multiple scientific articles and acts as a reviewer for a number of high-profile journals (e.g. American Journal of Orthodontics and Dentofacial Orthopedics). Additionally, he is a author and co-editor of two textbooks.