

Orthognathic Management of a High Angle Class II Division I Malocclusion Using a Passive Ligation System: A Case Report

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ABSTRACT

BACKGROUND Severe high angle Class II Division 1 malocclusion with vertical maxillary excess can be treated in several ways in growing patients. Early orthodontic treatment with vertical control may decrease the malocclusion as well as improve the appearance. In severe cases involving adults, orthognathic surgery often is the optimal solution. Presenting case: A 21 year old cadet officer from Malaysian National Armed Forces Defense University (UPNM) presented with a severe high angle skeletal Class II Division I Malocclusion complicated by bimaxillary protrusion, an increased overjet of 12 mm, increased overbite, severe dental crowding and absence of the 25 & 35. There was no obvious skeletal asymmetry. The lips were incompetent at rest. Investigations: Complete Orthodontic records were taken, including study models, clinical photographs, dental panoramic tomogram and lateral cephalograms in occlusion. Surgical planning was carried out using digital software Opal Imaging® 2.1. Clinical Management: Orthodontic preparations included de-crowding, leveling and alignment, de-compensation of incisors and arch coordination using the Damon® 3MX self-ligating system. Orthognathic surgery was carried out after the pre-surgical orthodontics was satisfactory done. The maxilla was brought 4mm forwards and subjected to differential impaction (anterior 2mm and posterior 4mm). The mandible was brought forward by 8 mm and downwards by 6mm. The patient also had an advancement genioplasty of the chin, which improved his profile remarkably. The fixed appliances were removed 6 months post-surgery after detailing the occlusion. The total treatment time was 28 months. Discussion: This cadet officer has since passed his course and is now proudly serving the nation of the Malaysian Armed Forces. He is being reviewed periodically for post-treatment stability.

KEYWORDS Orthodontics, Orthognathic surgery, Class II, High-angle

INTRODUCTION

Orthognathic treatment is defined as the treatment of dento-facial deformities to correct a wide range of minor and major skeletal and dental irregularities, including the misalignment of jaws and teeth. Orthognathic treatment has been shown to improve chewing, speaking and breathing.

While the patient's appearance may be dramatically enhanced as a result of these procedures, orthognathic treatment is performed to correct the underlying functional problems. The severity of these deformities precludes adequate treatment through dental or orthodontic treatment alone.

These include patients with named syndromes and conditions as follow:

1. Patients with significant jaw deformities, which result in functional and psycho-social disadvantages
2. Cleft lip and palate
3. Obstructive sleep apnoea
4. Hemi-facial microsomia
5. Condylar hyperplasia
6. Post-traumatic jaw deformities and malocclusions

The underlying abnormality may be present at birth or may become evident as the patient grows and develops or may be the result of traumatic facial injuries. The primary goal of treatment is to improve function through correction of the underlying skeletal deformity. The aforementioned patients commonly have dental malocclusions that cannot be managed by orthodontic treatment alone. All of these conditions are relatively uncommon but have been shown to have a devastating effect on patients in terms of function and integration into society.

The Dental Services of the Malaysian Armed Forces in Hospital Angkatan Tentera Tuanku Mizan (HATTM) have been offering OGS services regularly for the service personnel and their dependents for the past 9 years. This routinely involves a combined highly specialised approach to care between the Orthodontic and Oral- Maxillofacial Surgery team with the occasional input from our restorative, periodontology and prosthodontic counterparts. This combination of multi-disciplinary approach has been a successful and rewarding endeavor for our patients thus far.

CASE PRESENTATION

A cadet officer who was 21 years old presented to the orthodontic clinic with a high angle severe Class II malocclusion complicated by a hyperdivergent facial profile. He was otherwise medically fit and well and reported no allergies.

On examination, this cadet officer from UPNM presented with a severe high angle Class II, division I malocclusion. He complained about his general dental appearance especially the prominence of his upper front teeth. He expressed a lack of confidence to speak in public due to his overall dental condition. Extra-oral presentation showed that the Frankfort Mandibular Plane Angle was increased. No marked facial asymmetry was observed. The lips were incompetent at rest and he presented with a high-bridged nose. The profile also showed marked bimaxillary protrusion. Intra-oral examination showed a Class II, division I incisor relationship with an overjet of 11mm. The overbite was increased at 50% and the upper dental centre-line was displaced 2mm to the left. There was a vertical maxillary excess of 3mm. The lower dental centre-line was coincident with the mid-facial axis. 13 was buccally excluded and 45 was lingually excluded from the arches. The 25 and 34 were missing at presentation.

The cephalometric analysis confirmed that the patient exhibited a moderate to severe Class II skeletal pattern with 6.5° ANB angle. The maxillary-mandibular plane angle (MMPA) was raised at 34° which confirmed the high-angle nature of the skeletal Class II.

However, the lower face height to upper face height ratio was within the normal limit. The L1-Apo of 10.5mm confirmed bimaxillary prognathism. The chin point was severely retrusive at 22.5mm which confirmed the presence of severe mandibular retrognathism. The upper incisors were retroclined at 102.5° and the lower incisors were proclined at 100° for the given MMPA.

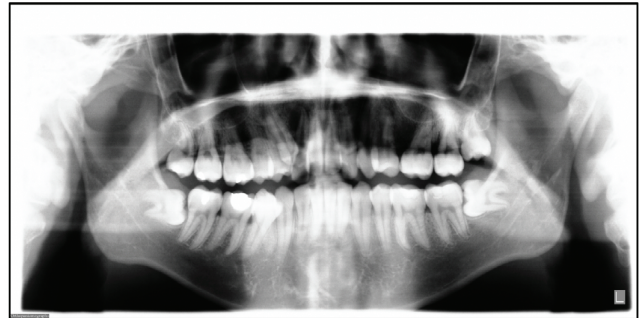


Figure 3. Dental Panoramic Tomogram (Pre-Treatment) Showing All Permanent Teeth Except 25 And 35 Were Present. The Lower Wisdom Teeth Were Horizontally Impacted



Figure 1. Extra-Oral Photographs at Initial Presentation



Figure 4. Lateral Cephalogram in Occlusion (Pre-treatment)



Figure 2. Intra-Oral Photographs at Initial Presentation

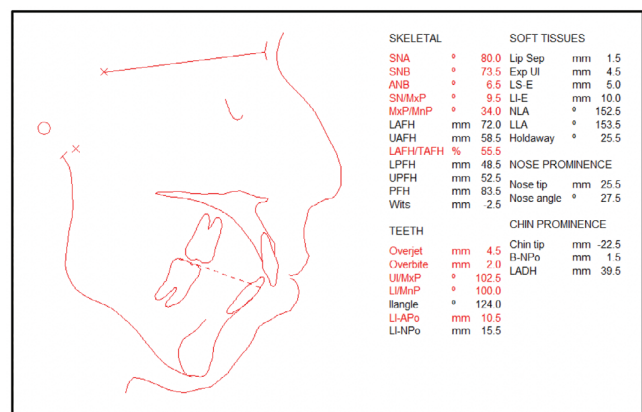


Figure 5. The Opal 2.0 Image Digital Cephalometric Analysis

Diagnostic Summary

This patient presented with a severe Class II Division I malocclusion complicated by increased maxillary-mandibular plane angles. This is accompanied by an overjet of 10mm, an increased overbite at 50% and the upper dental centre-line is deviated to the left hand side about 2mm. The molars are a full unit Class II. There is severe crowding of both arches where the 13 & 45 are both blocked-out of the line of arch. The upper labial segment is retroclined and lower labial segment is proclined due to dento-alveolar compensation. The mandible is retrognathic. There is also evident bimaxillary proclination. There was mild presence of vertical maxillary excess of about 3mm.

The Treatment Plan

Due to the marked skeletal disproportions in the sagittal and vertical plane, a combined orthodontic-surgical (orthognathic approach) was chosen to best address the underlying aetiology of malocclusion, which was largely skeletal in origin.

The pre-surgical orthodontics included:

- 1) Dental extractions of 14 & 45
- 2) Levelling and alignment of both arches
- 3) Space closure
- 4) Orthodontic decompensation of the incisors
- 5) Coordination of both arches

The surgical plan agreed upon by the orthodontic and surgical team was:

- 1) Maxillary advancement of 4mm
- 2) Differential maxillary impaction (anterior 2mm and posterior 4mm)
- 3) Mandibular advancement of 5mm and downwards by 8mm.
- 4) Advancement genioplasty by 3mm

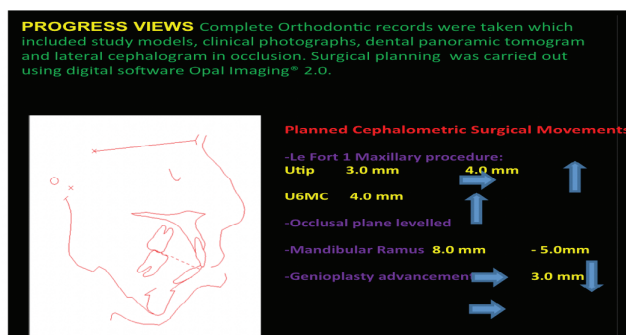


Figure 6. Cephalometric Software Using 2.1 Opal Imaging For Surgical Planning For Orthognathic Patients

Progress Report

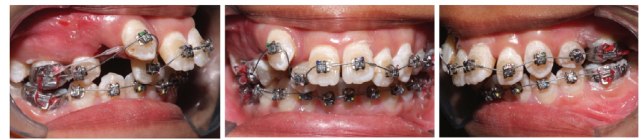


Figure 7. Initial Alignment Stages

The dental extractions were carried out and orthodontic treatment was commenced using the Damon 3MX® self-ligating bracket system with regular torque prescription. The first and second molars were banded. The orthodontic objectives of this case is to level and align the arches, close all spaces and coordinate the arches prior to surgery. This was established after 15 months. The archwires sequences used were maxillary and mandibular Damon 0.014" Niti, 0.014" x 0.025" Niti, 0.016" x 0.025" Niti, 0.016" x 0.025" Stainless Steel, 0.018" x 0.025" Niti and followed by 0.019" x 0.025" Stainless Steel working arch wires. After all spaces were closed, further leveling and aligning the arches was done. Both the arches were also coordinated by orthodontic manipulation of the archwires.



Figure 8. Mid-Treatment Extra-Oral and Intra-Oral Photos Prior To Surgical Correction. The Pre-Surgical Orthodontic Phase Took 15 Months

At 15 months into orthodontic treatment, the pre-surgical orthodontic objectives were achieved. These were confirmed by interim dental study casts as well as pre-surgical Dental Panoramic Tomogram and a lateral cephalometric analysis using well known digital cephalometric software advocated for Orthodontic trainees in the UK by the British Orthodontic Society, Opal Imaging ® version 2.1.

Clinically, there was a 10mm overjet and 50% overbite present. The dental centre-lines were corrected to the mid-facial axis. There was a mild vertical maxillary show with 3mm gingival show on smiling and 80% incisor show at rest. The Curve of Spee in the lower arch was leveled completely and the arches coordinated. The molars and canine relationship was a full unit Class II on both the left and right buccal segments.



Figure 9. Extra-Oral and Intra-Oral Photos Showing The Patient 2 Weeks After His Orthognathic Corrective Surgical Procedure

The patient underwent his bimaxillary orthognathic surgical procedure uneventfully and post-surgical elastics were instituted 2 days post-surgery to commence post-surgical detailing and settling of the occlusion. Post-surgery, there was only occlusal contact bilaterally on the second molars. Post-surgery, the buccal segments were ½ unit Class II and there was a open bite tendency. The lower dental centre-line was shifted 2mm to the right hand side.

Post-Operative Radiographs

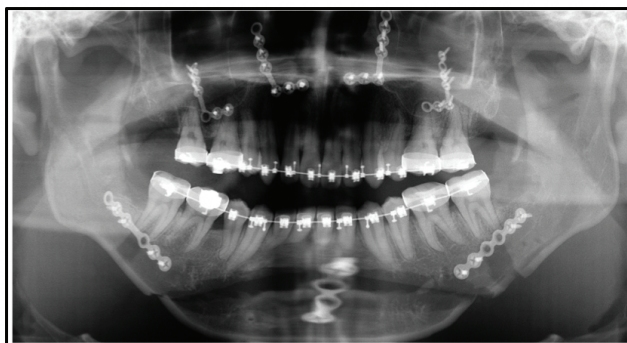


Figure 10. Dental Panoramic Tomogram (Post-Surgery) Showing the Surgical Plates In-Situ. All Wisdom Teeth and the 14 & 45 Have Been Extracted



Figure 11. Post-Operation Lateral Cephalogram Showing the Surgical Correction and The Patient Only Achieving Occlusal Contact on the Second Molars. There is an Anterior Open Bite Tendency

Result

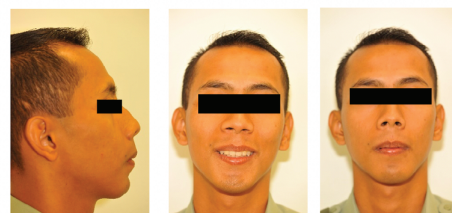


Figure 12. Extra-Oral and Intra-Oral Photo at Completion of Treatment

The patient was successfully debonded (braces removed) 6 months after surgery when the post-surgical orthodontic settling phase was completed. The occlusion was Class I with a 2mm overjet and a 20% overbite. His dental centre-lines were coincidental with the mid-facial axis. The buccal segment settled into a Class I with a mutually protective occlusal scheme. The patient was fitted with a Hawley retainer and reviewed 3 monthly during the retention phase of treatment. The patient has been periodically reviewed with no further problems. He was highly compliant throughout treatment. Treatment was completed in 28 months.

DISCUSSION

Skeletal Class II malocclusions with a hyperdivergent facial pattern are often difficult to treat without a combined surgical/orthodontic approach. Surgical repositioning of the maxilla, and possibly of the mandible, at the end of active growth is often the most realistic treatment option that would complement orthodontic treatment to achieve an overall improvement in facial aesthetics and provide a functionally stable occlusion for the patient. This is more so when there is an element of increased maxillary-mandibular plane angles such as in this case denoting that the patient exhibits a downward and backward growth rotations¹. These cases are well described in the orthodontic literature to be difficult to manage by orthodontic means alone.

Successful orthopedic/orthodontic treatment of a high-angle Class II division 1 malocclusion requires attentive evaluation of the components that contribute to the vertical skeletal disharmony in the vertical, horizontal and transverse planes.

The holistic approach of care was discussed and adopted when addressing the treatment of this patient. His underlying condition was best treated by a combination of orthodontics and surgery given his marked underlying skeletal discrepancy in the antero-posterior and vertical planes as he presented with a high ANB angle complicated by high angle and a retrusive chin of more than -22mm (Zero Meridien –Pogonion).

The superimpositions (Figure 14) of the pre-op and post-op cephalometric tracings showed the skeletal and dental changes achieved due to the orthognathic treatment. There is impaction of the maxilla and advancement of the mandible. The improvement in chin point (B point) due to the advancement genioplasty was evident.

Figure 15 showed that the patient's Rickett's E-plane has markedly improved post-treatment. The improvement of the profile of patient was largely due to the advancement genioplasty. This was seen by the improvement in the Pogonion to Zero-meridien (red plane).

Indications for Surgery in the Class II Patient

Proffit et al., 1992

- ST Profile-unfavourable
- Non-growing patients
- Asymmetries
- High Angle cases
- Anterior Open Bite of skeletal origin
- ANB > 9°
- Moderate to severe crowding
- Overjet > 10 mm
- Zero Meridian – Pogonion > 18mm
- Total Anterior Face Height > 125mm
- Mandibular length < 70 mm

Figure 13. Indicators for Surgery in The Class II Patient²

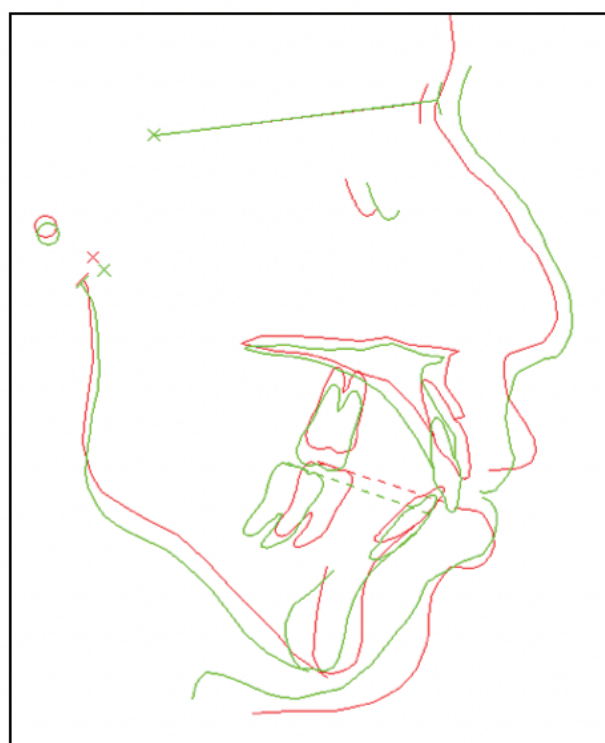


Figure 14. Superimposition of The Post-Operative Cephalometric Tracing Over the Initial Tracing. (Red Line=Pre-Op; Green Line = Post-Op)

There was a vast improvement in the aesthetic and functional outcome for the patient. He was very pleased and expressed an improved self-confidence and ability to meet and speak with peers, colleagues and friends. He is now serving proudly as an officer of the Malaysian Armed Forces.

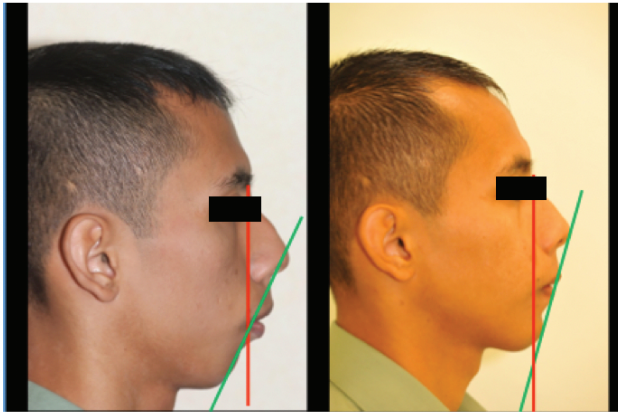


Figure 15. Shows A Comparison Between the Initial and Final Profile View (Green Plane)

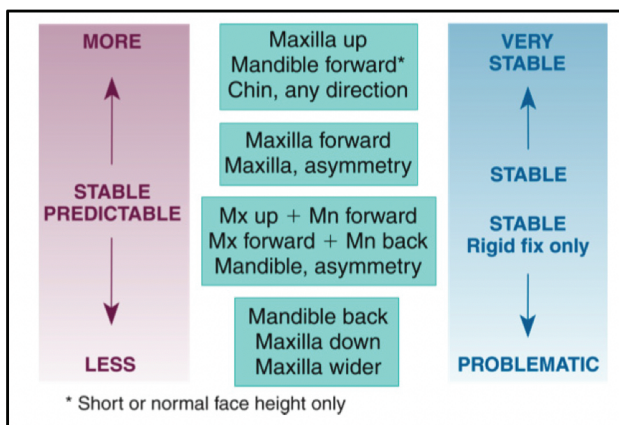


Figure 16. The Extended Hierarchy of Stability, Showing Relative Stability During the First Postsurgical Year 3

In modern day Orthodontics, although we have the technology to plan these complicated combined orthodontic and orthognathic surgical cases to perfection, we are limited by the outcomes of the surgical correction achieved and stability of the procedures.

The pre-surgical orthodontics aimed to remove the element of dento-alveolar compensation and coordinate the arches whereas the post-surgical orthodontics aimed to build in some compensation to compensate for the incomplete surgical correction of the high-angle skeletal Class II case using a passive self-ligating system. The reduced friction in the system and “play” in the system is said to facilitate these compensation mechanisms. Current research indicates this surgical procedure to be stable and favourable. Proffit et al ³ has shown that the surgical movements adopted in this case being the most stable. In reality, very few procedures are 100% successful, though high risks procedures may prove to be very successful⁴.

ACKNOWLEDGEMENTS

This case won the first prize for best clinical digital poster presentation at the 9th Asian Pacific Orthodontic Congress, Kuching, Sarawak in 2014 by a panel of renowned orthodontic academicians. Consent for publication has been sought from the patient for his records and photos to be used for educational purposes. The author would like to extend her appreciation to her Maxillo-facial surgical colleagues in Tuanku Mizan Hospital for their surgical input in managing this challenging Class II, Division I high-angle case.

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