



Case Report

Management of Severe Class II Malocclusion With Sequential Fixed Functional and Orthodontic Appliances: A Case for MOrthRCSEd Examination

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Abstract

Fixed functional appliance is an effective way of treating skeletal Class II malocclusion in children and adolescents. The following case report documented a 13-year-old boy with 15 mm overjet treated by a phase I 12-month growth modification therapy using Herbst appliance with Hyrax palatal expander and high pull headgear in a stepwise mandibular advancement protocol followed by a phase II pre-adjusted edgewise appliance therapy. It is one of the cases submitted for the Membership of Orthodontics Examination of the Royal College of Surgeons of Edinburgh. [*Singapore Dent J* 2010; 31(1):30–35]

Key Words: Class II malocclusion, functional appliance, Herbst appliance, growth modification

Introduction

Based on the incisor relationship, Class II malocclusion is defined as the lower incisor edges lie posterior to the cingulum plateau of the upper incisors resulting in an increase in overjet.¹ The prevalence of having an overjet > 10 mm was reported to be around 0.2% in the population.²

Large overjet, especially in children and adolescents, is associated not only with an increased risk of traumatic injury to the upper front teeth

but also psychological distress which results in loss of self esteem and problems with social interaction. Among different malocclusions, Class II malocclusion was rated as the most unattractive by both orthodontists and lay people.³ Albino⁴ assets appearance is the most common reason given for seeking treatments.

Class II malocclusion can usually be corrected by either extracting two upper premolars followed by retraction of the upper front teeth (camouflage) or advancing the mandible by growth modification or orthognathic surgery. There are still controversies about how effective is growth modification for the correction of large overjet. The following case report documented a 13-year-old boy with 15 mm overjet treated by a phase I growth modification followed by a phase II preadjusted edgewise appliance therapy. It is one of the cases submitted for the Membership of Orthodontics

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Examination of the Royal College of Surgeons of Edinburgh.

Case Presentation

Clinical examination and diagnostic summary

A 12-year and 11-month-old Chinese boy attended our clinic complaining of sticking out upper front teeth. He had convex profile, average nasolabial angle, retrognathic mandible and retruded chin. He presented in the permanent dentition with a Class II division 1 incisor relationship on a Class II skeletal base indicated by both ANB angle (+9.5°) and Wits appraisal (+11 mm). Overjet and overbite were increased at 15 mm and 6 mm respectively. The molar and canine relationships were one full unit Class II on both sides. There was mild to moderate crowding in both arches. The upper dental midline was on while the lower dental midline was deviated to the right by 2 mm from the mid-facial axis. He also had an anterior Bolton tooth size discrepancy due to relatively wider teeth in the lower anterior segment. The oral hygiene needed to be improved (Figure 1).

Aims of treatment

1. Improve oral hygiene
2. Enhance forward growth of the mandible to improve facial profile and jaw base relationship
3. Reduce overjet and overbite and achieve Class I incisor and buccal segment relationships
4. Relieve crowding and align teeth
5. Eliminate lip trap and improve lip competency

Orthodontic treatment comprised a phase I 12-month growth modification therapy using Herbst appliance with Hyrax palatal expander and high pull headgear in a stepwise mandibular advancement protocol and a phase II fixed pre-adjusted edgewise appliance treatment.

Treatment progress

Phase I growth modification therapy

The patient was referred to a dental hygienist for oral hygiene instruction and scaling and prophylaxis. After achieving a satisfactory oral hygiene level, orthodontic treatment commenced. A cast-silver splinted Herbst appliance⁵ was cemented



Figure 1. Pre-treatment intra-oral views.

with an initial mandibular advancement of 6 mm. A high pull headgear was issued 1 month later and was worn with 450g of force on each side for 12 to 14 hours per day. After 6 months, the appliance was activated by advancing the mandible for another 6 mm to achieve a reverse incisor relationship. At this stage, the Hyrax palatal expander was also activated at a rate of 0.5 mm per week for 12 weeks to achieve a palatal expansion of 6 mm (Figure 2).

Phase II fixed appliance

The Herbst appliance was removed after 12 months into treatment. The overjet was overcorrected to -3 mm. Crowding was relieved in the upper arch due to distalizing effect of the dentition as well as in the lower arch by proclination of the lower incisors. Both upper and lower arches were bonded

using 0.022"×0.028" slot pre-adjusted edgewise appliance with Roth's prescription and aligned with 0.014" Nickel Titanium (NiTi) wires. The archwires were subsequently changed to 0.016 NiTi and 0.017"×0.025" NiTi for further alignment and for torque control. After 6 months, 0.017"×0.025" Titanium Molybdenum Alloy (TMA) wire was then used to expand the lower buccal segments in order to create space to retrocline the lower incisors, while giving lingual root torque on lower canines at the same time to minimize risk of gingival recession. Twenty-seven months into treatment, the lower six anterior teeth were stripped to normalize the Bolton's ratio and to further retrocline the lower incisors on 0.018" stainless steel wire. 0.019"×0.025" stainless steel wires were used at the end of the treatment to coordinate the arch forms. The treatment was completed in



Figure 2. Headgear Herbst appliance fitted.

32 months. 0.018" twistflex fixed lingual retainers were delivered on both arches. Upper and lower Hawley's retainers were also issued as an additional protection measure against unnoticed debonding of the fixed lingual retainers.

Treatment change

The total treatment time was 32 months. An appreciable amount of sagittal and vertical mandibular growth was observed during the treatment period. The facial profile, measured as facial convexity angle, improved 7°. Jaw base relationship improved by 2.1° and Wits appraisal value improved by 6.5 mm despite the patient still has a Class II skeletal base. The use of high pull headgear during the functional appliance stage helped restraining downward and forward maxillary growth and also prevented clockwise rotation of the maxilla which might cause backward and downward rotation of the mandible thus jeopardizing the treatment effects.

Overjet and overbite were normalized to 3 mm and 1.5 mm respectively and Class I molar, premolar and canine relationships were achieved. The improvement of the occlusal relationship was a result of mandibular skeletal and maxillary and mandibular dental changes. Class II molar correction was mainly due to an increase in mandibular length and posterior movement of the maxillary molars. Overjet correction was mainly due to an increase in mandibular length and proclination of lower incisors and posterior movement of upper incisors. According to the sagittal-occlusion analysis,⁶ overjet improvement of 18.5 mm was due to 38% skeletal and 62% dental changes, while molar improvement was due to 47% skeletal and 53% dental changes. Patient could close his lip without difficulty at this moment despite some lip incompetence still existed. A 97.8% reduction in PAR score was achieved with the initial PAR score of 45 points reduced to 1 point post treatment. This can be categorized as greatly improved (Figures 3–6).

Discussion

Treatment rationale

In many respects the patient was a suitable candidate for functional appliance treatment. He presented with a moderate Class II skeletal discrepancy,

reduced lower facial height proportion, mild crowding in the upper arch and proclined upper incisors, with the lower incisors of average inclination. He was in the pubertal growth spurt period and this was the appropriate timing to modify his growth. The functional appliance was used to improve the skeletal discrepancy and to reduce the facial convexity by restraining the maxillary growth, advancing the mandible and moving the chin point forward, and correcting incisor and buccal segment relationships to Class I. As a result of the potential skeletal and dentoalveolar changes produced by the functional appliance, a more favourable soft tissue environment was created with elimination of the lip trap which tended to procline the upper incisors.

Fixed functional appliance, which was Herbst appliance in this case, was used because we could minimize any potential compliance problem⁷ and maximize the efficiency of the treatment. Mandibular advancement every 6 months in a stepwise manner has been proved more effective in stimulating condylar growth and improving mandibular prognathism.⁸ Herbst appliance incorporating with high-pull headgear could restrain the undesirable vertical growth of the maxilla, which in turn reduced the downward and backward rotation of the mandible which would compromise the Class II correction.⁹

Two phase vs. one phase treatment

The patient was treated in 32 months, including 12 months of growth modification and 20 months of fixed appliance therapy. The main aim of the two phase orthodontic treatment was to enhance the patient's potential for favourable mandibular growth and improve his skeletal and soft tissue profile by growth modification. It was also planned to avoid over retraction of his upper incisors with respect to the incisor angulations, future nasal growth and his existing smile line. The originally convex profile could be worsened if this mild-to-moderate crowding case was treated with extraction. We were able to maintain the upper lip profile of the patient while improving the retrusive mandible by functional appliance treatment.

Lower incisors proclination is one of the major side effects of functional appliances. In this case, the lower incisors were proclined as a result of anchorage loss from the Herbst appliance and also from the fixed appliance using round wire for

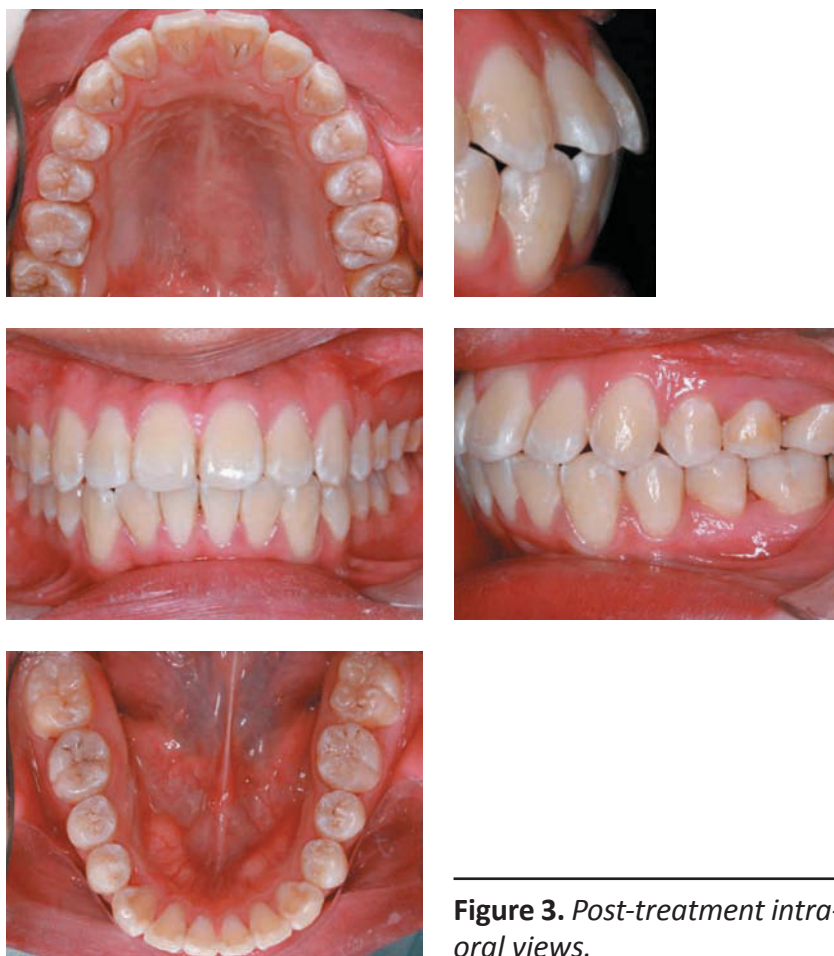


Figure 3. Post-treatment intra-oral views.

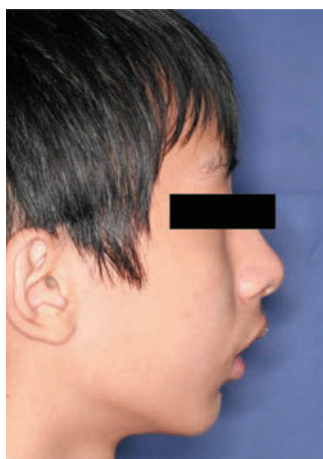


Figure 4. Pre-treatment profile.

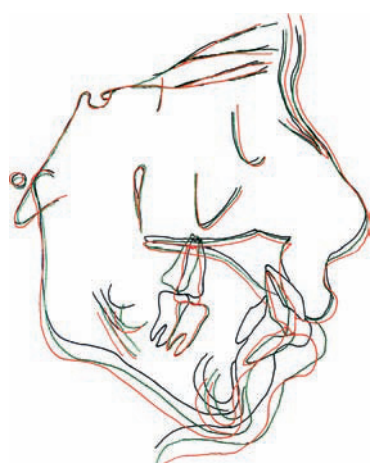


Figure 5. Post-treatment profile.

crowding relief. The proclination improved in the fixed appliance stage due to occlusal recovery and the teeth retroclined into the space created by rounding off the molar and premolar area. There was no gingival recession noticed at the end of treatment which was in agreement with Ruf's study¹⁰ and this was because the patient was still growing and the alveolar bone followed the movement of the teeth. However, gingival recession

and root resorption might be potential risks from excessive lower incisor proclination especially in adults where growth has finished and therefore extra care has to be taken.

The prognosis for stability was good provided the patient's growth pattern was favourable and the mandible would not rotate downward and backward. Good buccal interdigitation and incisal contact also helped stabilize the occlusal stability,



— Pre-treatment
 — Post-headgear Herbst appliance
 — Post-treatment

Figure 6. Superimposition of pre-treatment, mid-treatment and post-treatment radiographs.

as well as the fixed retainers and removable retainers. Fixed retainers should be in place as long as possible as the incisors were rotated before the treatment.

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