

**CLINICAL  
SECTION**

# Combined orthodontic–dentofacial orthopedic treatment of a Class II division 2 patient with severe deep bite

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The following case report is the multi-stage, non-extraction orthodontic–dentofacial orthopaedic treatment of a Class II division 2 patient with severe deep bite (14 mm). It was one of the long cases presented in the Conjoint M.Orth. R.C.S. (Edin.) examination held in Hong Kong, 1999 and awarded the Gold Medal Prize in that examination.

## Orthodontic diagnosis and treatment planning

The patient was a 12-year-old Chinese boy with a chief complaint of irregular teeth. The medical history was clear, and the dental history, family, and social history were not relevant.

Extra-oral examination (Figure 1a,b) showed that he had a convex profile. The lower facial height was average, the nasolabial angle was 90 degrees, and the labiomental fold was deep. The chin was retrusive and the face was symmetrical on frontal view. The upper and lower dental midlines were 1 mm to the right and the lips were competent. The temporomandibular joints were normal. He was 153.6 cm tall and his voice was prepubertal.

Intra-oral examination (Figure 1c–i) showed that there was chronic marginal gingivitis and the oral hygiene needed to be improved. There were mild generalized enamel defects and gingival stripping on 31. The dental stage was early permanent dentition with the canines and premolars erupted.

The lower arch form was asymmetrical and the curve of Spee was increased (Figure 1 f). In the anterior segment, 33–41 were retroclined and 42 showed signs of attrition. In the posterior segment, the teeth were well aligned.

The upper arch form (Figure 1g) was asymmetrical and the curve of Spee was reversed. In the anterior seg-

ment, 11, 21, and 22 were retroclined, and there were indentations in the palatal mucosa. In the posterior segment, the teeth were well aligned.

Assessment of the inter-arch relationship (Figure 1c–e) showed that the molar relationship was Class II, the canine relationship was Class II and the incisor relationship was Class II division 2. The overjet was 1 mm and the overbite was 14 mm.

Analysis of plaster casts showing there was 2 mm crowding in the upper arch and 1 mm crowding in the lower arch.

The pretreatment orthopantomogram confirmed that all permanent teeth were present and the wisdom teeth were developing. Pretreatment lateral cephalogram analysis (Figure 2) revealed:

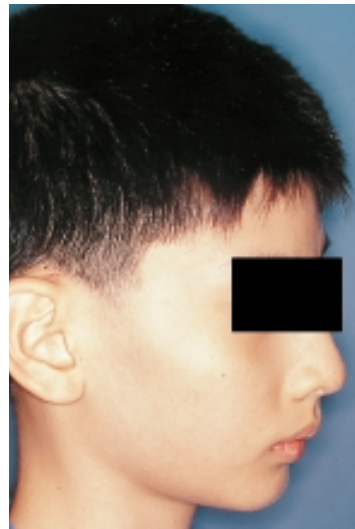
- normal skull base angle;
- skeletal 2 pattern;
- retruded chin;
- retroclined upper and lower incisors;
- retruded upper and lower lips;
- low mandibular plane angle and balanced facial heights.

The problem list for the patient included:

- a convex facial profile;
- Class 2 skeletal pattern;
- retrusive chin;
- Class II molars;
- Class II division 2 incisors;
- deep overbite;
- increased curve of Spee;
- low mandibular plane angle;
- shifted upper and lower midlines;
- asymmetric upper and lower arches;
- upper and lower anterior crowding;



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)

**Fig. 1** Pretreatment.

- tilted teeth;
- gingival stripping;
- palatal indentation;
- generalized enamel defects;
- attrition 42, gingivitis, and poor oral hygiene.

Treatment need of the patient was great (IOTN grade 4) and the patient's demand for treatment was high.

The treatment objectives included normalization of basal relationship, normalization of overjet and overbite, alignment of teeth, and co-ordination of arches with correction of the traumatic occlusion.

Three treatment alternatives were considered.

*Option 1: (growth modification)*

1. Alignment of upper arch by simple fixed appliance.
2. Functional appliance (Headgear Activator, van Beek style).
3. Fixed appliances.

*Reasons for considering option 1.* The patient was skeletal II relationship and facial profile showed retrusive chin. Having prepubertal voice, he was near the peak of the growth spurt, so a growth modification approach could be considered. Simple fixed appliance would be used to align and procline the upper anteriors so that the mandible could be advanced during the headgear activator therapy. Finally, fixed appliances would be used to finalize the occlusion. A non-extraction approach was recommended because the lower incisors were retroclined and the bite was deep.

*Option 2: (orthodontic only treatment)*

1. Extract 14, 24.
2. Upper arch: fixed appliance.
3. Lower arch: fixed appliance.

*Reasons for considering option 2.* Extraction of 14, 24 would provide space for retraction of upper anteriors. A non-extraction approach was recommended in the lower

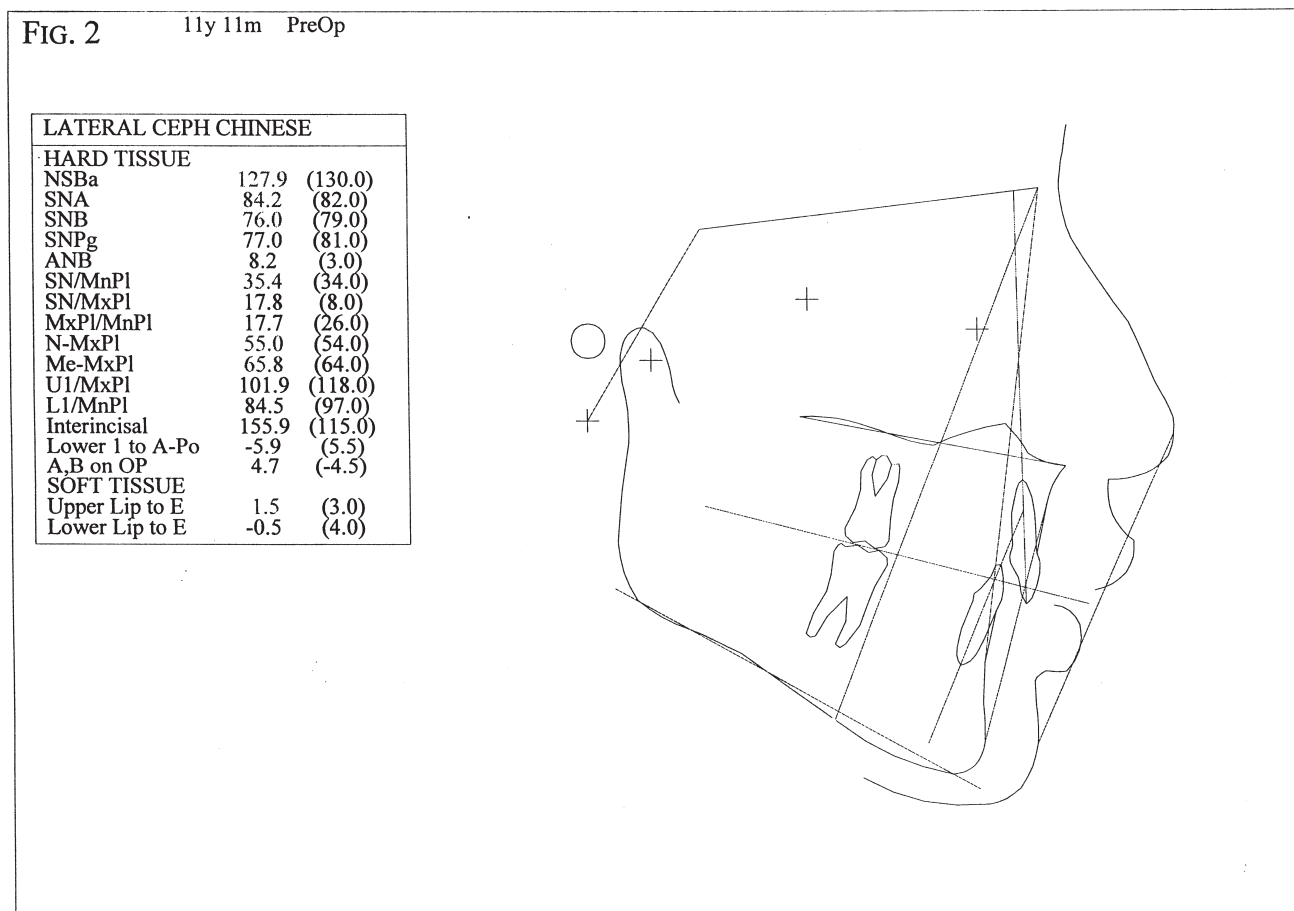
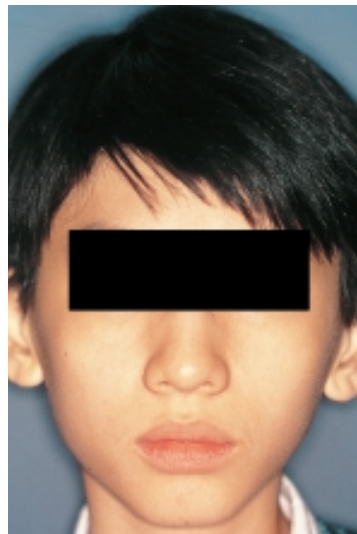


Fig. 2 Pretreatment lateral cephalometric analysis, bracketed figures are Southern Chinese average values.



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(i)



(h)

**Fig. 3** Post-treatment.

arch because the lower incisors were retroclined and the bite was deep. This option would produce compromised results because it could not improve the profile.

*Option 3: combined surgical orthodontic therapy*

1. Monitor growth and development.
2. Presurgical orthodontics to align the teeth.
3. Mandibular advancement surgery.
4. Post-surgical orthodontics to finalize the occlusion

*Reasons for considering option 3.* Patient was skeletal 2 and facial profile showed retrusive chin. Orthognathic surgery would correct the skeletal discrepancy.

The treatment options were fully discussed with the patient and his parents. They decided to proceed with the growth modification option (Option 1).

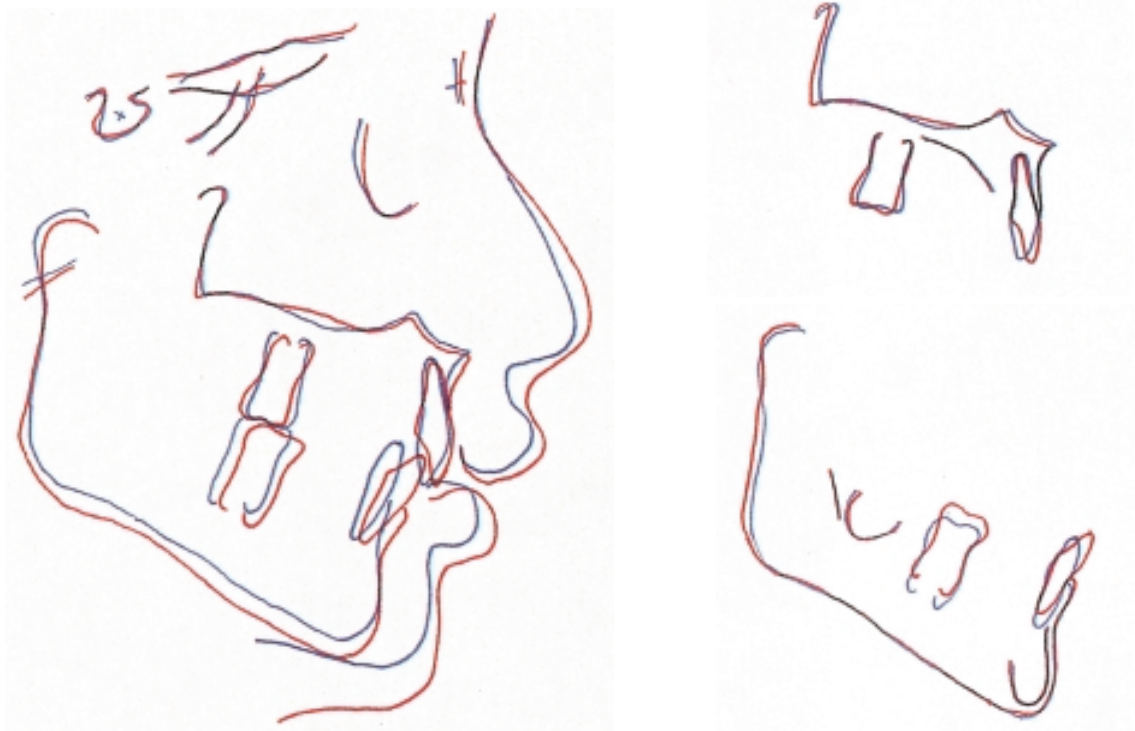
### Treatment progress

The oral hygiene of the patient was monitored regularly. Scaling and oral hygiene instructions were given by a hygienist, and daily fluoride mouthwash was recommended.

The initial treatment was to align and procline the upper anterior teeth so as to create an overjet for

mandibular advancement during Headgear Activator therapy. It began with an upper two by six 0.022-inch slot pre-adjusted Edgewise appliance with an 0.014-inch nickel titanium (NiTi) archwire for alignment of the anterior teeth. Two months after treatment began an upper 0.018-inch Australian (Special Plus) archwire with advancing loops mesial to the molar buccal tubes was used for further alignment and incisal proclination of the anteriors. Four months into treatment, the appliance was removed and an upper Hawley retainer was issued.

The next stage of treatment was to modify growth. Five months after starting treatment, impressions and jaw relation records were taken for the Headgear Activator (van Beek style). The Activator and headgear were fitted 6 months into treatment. Only light force was applied and the duration of wearing was progressively increased. An upper Hawley retainer was worn during the day. Seven months into treatment, the upper occlusal surfaces of the Headgear Activator distal to the canines were trimmed flat to allow buccal movement of upper posterior teeth. The extra-oral force was increased to above 500 g, with the duration of wear was 14 hours a day. Nine months after treatment began, the lower occlusal surfaces of the Headgear Activator distal to the canines were trimmed to allow for the reduction of the



**Fig. 4** Superimposition on anterior cranial base, before (blue) and after (red) activator treatment.

lower curve of Spee. Eleven months after treatment, the overjet was 1.5 mm, and the molar relationship was Class III on the left side and Class I on the right side.

The third stage of treatment began with the cessation of Headgear Activator. After 12 months of treatment, upper and lower pre-adjusted Edgewise appliances of 0.022-inch slot were fitted. The teeth were aligned with sectional 0.014-inch NiTi archwires. A 0.018-inch Australian (Special Plus) archwire was placed on upper arch prior to an 0.019-inch  $\times$  0.025-inch stainless steel archwire for further alignment of teeth. An upper anterior bite plane was then placed to aid levelling of the lower curve of Spee. Seventeen months into treatment, 37, 47 were banded and included in the lower appliance. The lower arch was aligned with 0.018-inch NiTi archwire. After 2 months a lower 0.019  $\times$  0.025-inch stainless steel archwire was placed for further alignment of teeth and flattening of the curve of Spee. Twenty months into treatment, 13, 23 were retracted with NiTi closed-coil spring. Class II elastics (150 g each side) were applied full time.

After retraction of upper canines, space closure of upper arch was performed with sliding mechanics using NiTi springs supported with Class II elastics. Twenty-five months into treatment, buccal tubes were bonded on 17, 27. A sectional NiTi archwire was used to align 17, 27. An upper 0.016  $\times$  0.022-inch finishing titanium molybdenum alloy (TMA) archwire was placed at the next visit for fine detailing.

The appliances were debonded after 27 months of active treatment (Figure 3). Upper and lower Hawley retainers were provided for daytime wear, with a passive activator for bedtime wear. The patient would be reviewed for fixed lingual retainers.

## Results achieved

### *After initial alignment and headgear activator*

Facial analysis showed that the lateral profile changed slightly and the face was symmetrical on frontal view.

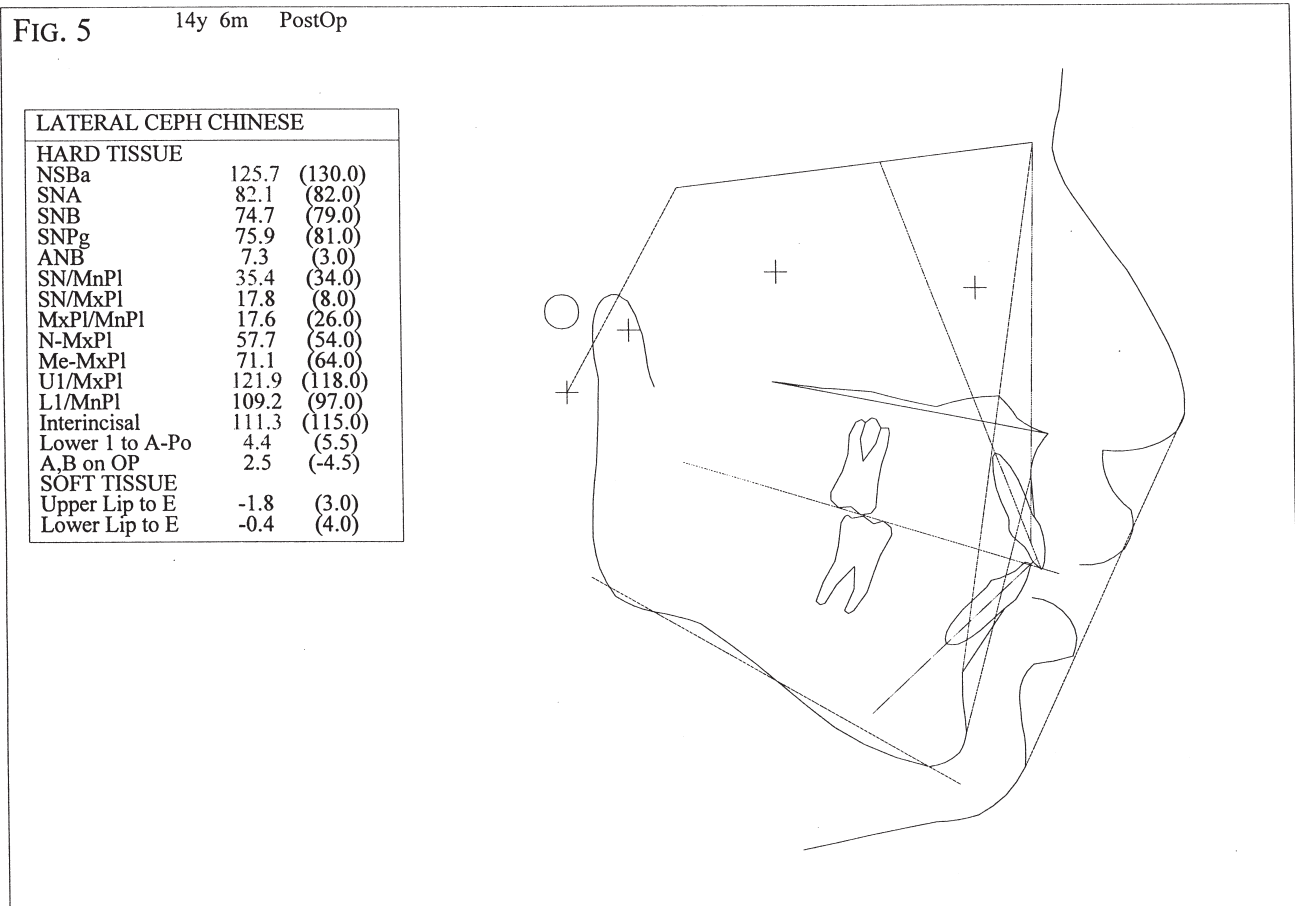


Fig. 5 Post-treatment lateral cephalometric analysis, bracketed figures are Southern Chinese average values.

Occlusal inspection showed that the oral hygiene was improved.

In the lower arch, the arch form was symmetrical and was parabolic-shaped, and the curve of Spee was deep. In the anterior segment, the teeth were mildly crowded and retroclined. In the posterior segment, the teeth were generally well aligned.

In the upper arch, the arch form was symmetrical and was parabolic-shaped, and the curve of Spee was minimal. In the anterior segment, the teeth were well aligned, but upright. In the posterior segment, the teeth were well aligned.

Analysis of the inter-arch relationship showed that sagittally the molar relationships were Class III on the left side and Class I on the right side. The incisor relationship was Class II division 2. The overjet was 1.5 mm at 41 and vertically the overbite was decreased to 9 mm.

Superimposition of lateral cephalometric radiographs before and after initial alignment, and headgear activator treatment at cranial base along natural reference structures (Figure 4) showed:

- downward and forward growth of face;
- slight downward and forward growth of maxilla;

- elongation of nose and correction of molar relationship;
- slight proclination of upper incisors and distalization of upper molars;
- slight upward and backward growth of mandible;
- proclination and extrusion of lower incisors, and extrusion and mesial movement of lower molars.

#### *After fixed appliance treatment*

Facial analysis (Figure 3a,b) showed that the convex lateral profile slightly decreased and the chin was less retrusive. The face was symmetrical on frontal view. The upper and lower dental midlines were corrected.

The second permanent molars were erupted. In the lower arch the arch form was symmetrical parabolic and the curve of Spee was minimal. The teeth were generally well aligned (Figure 3c–i).

In the upper arch the arch form was symmetrical parabolic, the curve of Spee was mild.

Analysis of inter-arch relationship showed the molar relationship was Class I, the canine relationship was Class I, and the incisor relationship was Class III. The overjet was 1mm. and the overbite was overcorrected to 0.5 mm (reduced from 14 mm).



**Fig. 6** Superimposition on anterior cranial base, before (blue) and after (red) fixed appliance treatment.

Analysis of post-treatment lateral cephalogram (Figure 5) revealed normal skull base angle, skeletal 2 pattern, decreased facial heights, and upright incisors.

Superimposition of tracings of the lateral cephalometric radiographs (Figure 6) showed:

- downward and backward rotation of mandible;
- downward growth of maxilla and elongation of nose;
- proclination of upper incisors;
- slight mesial movement of upper molars;
- proclination of lower incisors and extrusion of lower molars.

Analysis of the PAR Index showed that the pretreatment index was 24 and the post-treatment index was 0. There was a 100 per cent reduction of PAR Index, putting the changes in the 'greatly improved' category.

### Acknowledgements

I would like to thank Professor Michael S. Cooke, Professor in Orthodontics, Faculty of Dentistry, the University of Hong Kong, who gave me invaluable clinical supervision and advice during the treatment of this patient and writing up of this report.