

**CLINICAL
SECTION**

American Orthodontics Maurice Berman Prize 2005

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This paper describes the orthodontic treatment of two cases, which were awarded the 2005 Maurice Berman Prize.

Key words: Orthodontics, clinical case reports, condylar resorption, distraction osteogenesis, cardiac abnormalities

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Introduction

The Maurice Berman Prize is held annually and under the current regulations, entry is open to the winner of the previous year's MOrth cases prize who is invited to submit the same two cases or two cases from any SpR (FTTA (Fixed Term Training Appointment)) who has passed the Intercollegiate Specialty Fellowship Examination (ISFE) during the previous 12 months. The prize is awarded for demonstrating the highest level of clinical ability. The initial severity of the case, optimal facial and dental aesthetics, final occlusion, and quality and completeness of the photographic record are taken into account. The two cases described here were successfully submitted for the award in 2005 having been completed during the FTTA period leading up to the ISFE in October 2004.

Case report 1

A 14-year-old Caucasian male was referred by his General Dental Practitioner regarding crowding. The main features of his malocclusion were a mild Class II division 1 malocclusion on a mild skeletal II base with increased vertical skeletal relations. In addition, there was an anterior open bite and the molar relationship was a $\frac{3}{4}$ unit Class II on the right and $\frac{1}{2}$ unit Class II on the left. Both upper lateral incisors were in crossbite and the upper central incisors exhibited intrinsic discoloration.

The patient had a complex medical history, having been born with pulmonary atresia and a hypoplastic right ventricle. In order to manage these cardiac abnormalities the patient had undergone a balloon septostomy and a shunt procedure in the first week of life, and his last operation had been 7 years earlier for total cavo-pulmonary connection surgery. The patient was taking 5 mg of warfarin medication daily.

Extra-oral assessment

He presented with a mild Class II skeletal pattern with an increased Frankfort-mandibular planes angle and lower face height ratio. Soft tissue assessment revealed lips of normal length, which were incompetent, but habitually held together.

Intra-oral assessment

All permanent teeth were present except the third molars. The dentition was unrestored and caries free. His oral hygiene was fair with mild gingivitis associated with the maxillary central incisors and canines. Both upper central incisors exhibited intrinsic discoloration.

In the mandibular arch there was imbrication of the lower labial segment and well-aligned buccal segments. In the maxillary arch there was moderate crowding of the upper labial segment with palatally excluded upper lateral incisors. The buccal segments were reasonably well aligned.

The incisor relationship was Class II division 1 with an overjet of 4 mm and an anterior open bite of 1 mm. The lower centreline was correct and the upper displaced to the left by 2 mm. The right buccal segment relationship was $\frac{3}{4}$ unit II and on the left $\frac{1}{2}$ unit II. The upper lateral incisors were in crossbite. There were no displacements (Figure 1).

The Dental Health Component score on the Index of Treatment Need was 4d. The pre-treatment weighted Peer Assessment Rating (PAR) was 55.

Special investigations

Radiographs. The panoramic radiograph (Figure 2) revealed a full complement of teeth excluding third molars, with root lengths and bone levels within normal limits. The lateral cephalogram (Figure 3) indicated a



Figure 1 Case report 1: pre-treatment photographs

skeletal II pattern with mild mandibular retrognathia. SNA was 81° and SNB was 76° with an ANB of 5° . The maxillary mandibular planes angle and anterior face height ratio were both increased. The upper incisors were retroclined at 98.5° and the lower incisors were retroclined at 82.5° . Cephalometric analysis is presented in Table 1.

Aetiology

The Class II skeletal base relationship is likely to be inherited¹ and has resulted in Class II buccal segments. The high maxillary mandibular planes angle of 33.5° and increased lower anterior face height ratio has contributed to the anterior open bite. In addition, there

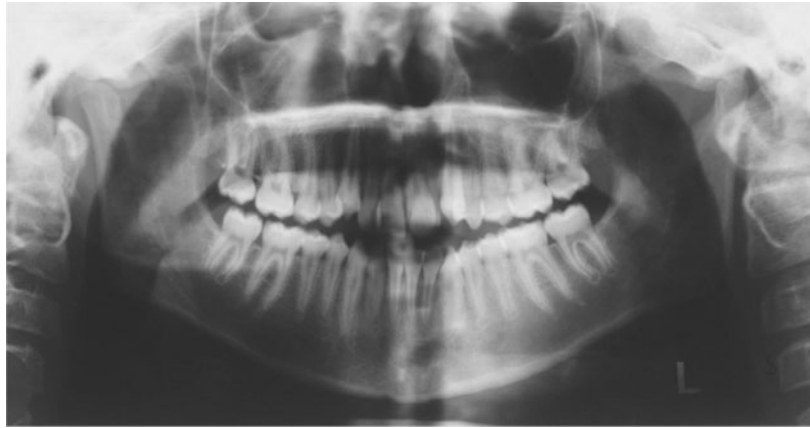


Figure 2 Case report 1: pre-treatment orthopantomogram

was dentoalveolar disproportion, which has resulted in palatal displacement of the maxillary lateral incisors.

Aims of treatment

- Relief of crowding.
- Levelling and alignment of the arches.
- Localization of upper arch space to align 2/2.
- Class I molar and canine relationship.
- Correct overjet and establish positive overbite.
- Space closure.
- Treat the intrinsic enamel discoloration.
- Retain.



Figure 3 Case report 1: pre-treatment lateral cephalogram

Treatment plan

- Liaise with the Consultant Paediatric Cardiologist to establish appropriate antibiotic regime and Warfarin management.
- Improve oral hygiene.
- Extraction of upper first and lower second premolars under antibiotic cover.
- Fit upper and lower pre-adjusted Edgewise fixed appliances (MBT™ prescription) using bondable tubes on molars to avoid the need for tooth separation.²
- Detail the occlusion.
- Retention.

Treatment progress

After liaising with the Consultant Paediatric Cardiologist treatment began with oral hygiene instruction. Once an improvement in oral hygiene was noted the extractions were arranged ahead of appliance placement. On review, the INR was 2.4 (target range

Table 1 Case report 1: pre- and post-treatment cephalometric analysis

	Pre-treatment	Post-treatment
SNA (°)	81	79.5
SNB (°)	76	76
ANB (°)	5	4
MMPA (°)	33.5	34.5
SnMx plane (°)	5.5	6
LAFH/TAFH (%)	56.5	56.5
UI/Mx plane (°)	98.5	102.5
LI/Mn plane (°)	82.5	86
I/I angle (°)	145.5	137
LI/APo (mm)	0	1.5

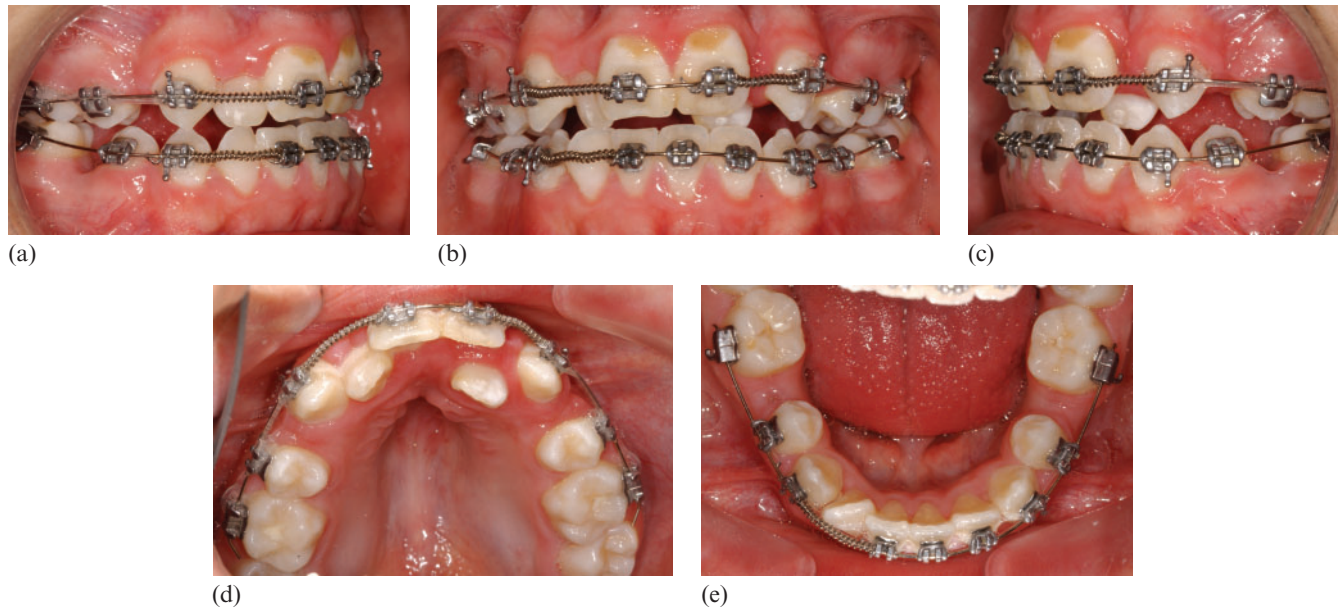


Figure 4 Case report 1: space recreation for both maxillary and lower right lateral incisors on 0.018-inch stainless steel arch wires

2.0-3.0). Warfarin medication was stopped 3 days pre-operatively and restarted 12 hours after extraction of upper first and lower second premolars under antibiotic cover (intravenous amoxicillin 1 g and intravenous gentamicin 2 mg/kg=80 kg). To ensure that haemostasis was achieved and maintained, the extraction sockets were packed with Surgicel and sutured with 4/0 vicryl sutures.

Following a period of healing post-extraction, pre-adjusted Edgewise brackets and bondable tubes (0.022 × 0.028-inch slot, MBT™ prescription) were placed on all fully erupted teeth in the upper and lower arches, with the exception of both upper and lower right lateral incisors and the second molars, avoiding unwanted extrusion of these teeth in this high angle case with deficient overbite. A laceback was placed in the upper left quadrant to begin canine retraction, a 0.016-inch super-elastic nickel titanium arch wire was placed to begin maxillary alignment and a 0.014-inch super-elastic nickel titanium arch wire was used in the mandible. The lower arch wire was cut distal to the first premolars to avoid the possibility that it may have been pulled out of the bondable tubes on the lower first molars. Prior to bracket placement and at the outset of each subsequent appointment the patient rinsed with chlorhexidine gluconate mouthwash 0.2%, which he was also encouraged to use daily. After 6 weeks 0.018-inch stainless steel arch wires were placed in both arches with activated pushcoils to recreate space for UR2, UL2 and LR2. In addition, power chain was placed from the upper first molars to the canines to begin retraction of

these teeth (Figure 4). Once there was sufficient space to align all the teeth a progression of super-elastic nickel titanium arch wires were used until upper and lower 0.019 × 0.025-inch stainless steel working arch wires were placed. Final spaces were closed using active ligatures in both maxillary quadrants and nickel titanium closing springs in the mandible. Sagittal correction of the occlusion was maintained during space closure by the use of green Class II elastics (3½ ounce, 5/16-inch). A lateral cephalogram (Figure 5) taken near the end of treatment showed that additional maxillary incisor torque was required and this was added to the upper 0.019 × 0.025-inch stainless steel arch wire.

Following debond, upper and lower Hawley retainers were fitted. The end of treatment photographs are shown in Figure 6.

Case 1 assessment

The duration of active treatment was 23 months. There has been a significant improvement in dental aesthetics. Treatment objectives have been achieved using anchorage provided by the extraction pattern, which also relieved the crowding, and allowed for correction of the centerline and overbite. The torque provided by the pre-adjusted Edgewise appliances and additional arch wire bending has improved the inclination of the incisors and the interincisal angle. Extrorally there has been little facial change, with the patient still having lip incompetency at the end of treatment. Cephalometric superimposition demonstrates that the



Figure 5 Case report 1: near-end-of-treatment lateral cephalogram

skeletal antero-posterior discrepancy has improved with a reduction in the ANB value of 1° , but the maxilla and mandible have grown downwards with no appreciable change in the maxillary mandibular planes angle (MMPA) or lower face height ratio (LFH%). Both the upper and lower face heights have increased with growth during treatment (Figure 7).

The post-treatment PAR score is 2, which demonstrates a 96% reduction in weighted PAR score.

Case report 2

A 17-year-old Caucasian male was referred by a colleague in the Oral and Maxillofacial Department having had his occlusion decompensated by a practitioner in the primary care setting ahead of orthognathic surgery. The main features of his malocclusion were a mild Class II Division 1 malocclusion on a severe, skeletal II base with mandibular micrognathia and increased vertical skeletal relations. He initially presented with fixed appliances *in situ* having had four premolars removed and spaces closed. His major

concern was the lack of chin projection and following a long period of time in fixed appliances he wanted his treatment to be completed as soon as possible.

Extra-oral assessment

He presented with a severe Class II skeletal pattern with mandibular micrognathia; an increased Frankfort mandibular planes angle (FMPA); reduced chin prominence and posterior face height. Soft tissue assessment revealed an increased nasolabial angle (Figure 8a–d).

Intra-oral assessment

All permanent teeth were present with the exception of the third molars and the second premolars. Oral hygiene was fair.

In the mandibular arch there was mild incisor imbrication and proclination of the lower labial segment was still compensating for the skeletal base relationship. The maxillary arch was well aligned with the incisors being upright.

In occlusion the incisor relationship was Class II division 1 with an overjet of 6 mm and a mild anterior open bite. The centerlines were correct and coincident with the facial midline. The buccal segment relationship was Class I bilaterally (Figure 8e–i).

The Dental Health Component score on the Index of Treatment Need was 2a and the pre-treatment weighted PAR score was 22, although in a case such as this neither index is particularly sensitive to measuring the need for treatment and outcome.

Special investigations

Radiographs. The panoramic radiograph (Figure 9) revealed a full complement of teeth with the exception of all four extracted second premolars. The lower incisor roots appear foreshortened due to their excessive proclination and there is evidence of bilateral condylar resorption. The lateral cephalogram (Figure 10) indicated a severe skeletal II pattern with an ANB of 12° principally due to mandibular retrognathia ($SNB=67.5^\circ$). The maxillary mandibular planes angle was increased at 39.5° , but the lower anterior face height ratio was reduced at 52%. The upper incisors were retroclined at 94.5° and the lower incisors were proclined at 112° , giving rise to a lower labial segment compensated with respect to the skeletal pattern. Cephalometric analysis is presented in Table 2.

Aetiology

In the absence of a history of mandibular trauma or progressive disease such as Stills, the micrognathia is



Figure 6 Case report 1: post-treatment photographs

likely to be congenital. The reduced posterior face height and associated high maxillary mandibular planes angle accounts for the anterior open bite. The lower incisor proclination is due to compensation for the underlying

skeletal pattern, whilst the increased nasolabial angle and upper incisor retroclination was the result of previous upper arch extractions and orthodontic treatment. Condylar resorption is a risk factor where

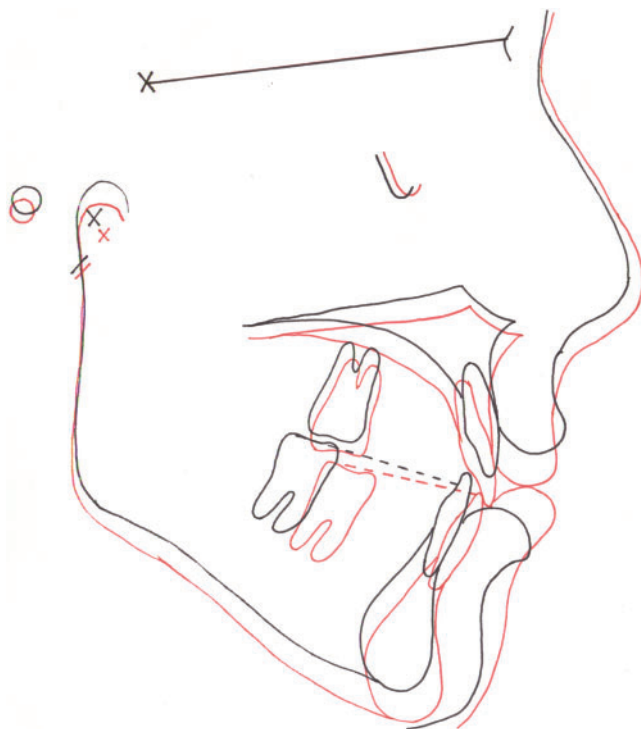


Figure 7 Case report 1: pre- (black) and post-treatment (red) cephalometric superimposition

orthodontic treatment is undertaken in a patient with a high angle Class II malocclusion with marked ante-gonial notching and a reduced posterior face height.³

Aims of treatment

- Improve oral hygiene.
- Reduce the severe skeletal II pattern with a combined orthodontic-surgical approach to:
- increase the vertical dimension of the hypoplastic mandibular rami;

Table 2 Case report 2: pre-treatment and post-treatment cephalometric analysis

	Pre-treatment	Post-treatment
SNA (°)	79.5	79
SNB (°)	67.5	68
ANB (°)	12	11
MMPA (°)	39.5	44.5
SnMx plane (°)	11	10.5
LAFH/TAFH (%)	52.5	56.5
UI/Mx plane (°)	94.5	100
LI/Mn plane (°)	112	97.5
I/I angle (°)	114	118
LI/APo (mm)	8.5	6.5

- increase the antero-posterior dimensions of the mandibular body and symphysis;
- improve the chin projection to achieve a more harmonious facial profile.
- Correct the overjet.
- Establish a positive overbite.
- Retain.

Treatment plan

- Oral hygiene instruction.
- Upper and lower pre-adjusted edgewise fixed appliances to decompensate the upper labial segment and align both arches in the first instance without further loss of teeth.
- Distraction of the vertical rami of the mandible with intra-oral paediatric distractors.
- After consolidation of the bone, review the need to extract teeth in the lower arch to allow space for decompensation of the lower labial segment, possibly followed by bimaxillary surgery to level the occlusal plane by down grafting the maxilla posteriorly and further advancing the mandible.
- Genioplasty (and possibly rhinoplasty).
- Retention with upper and lower Hawley retainers.

Rationale for treatment

Treatment with distraction osteogenesis was decided upon in preference to orthognathic surgery because this avoided bone graft donor site morbidity that would have resulted from conventional inverted L osteotomies. In addition, Williams and McCarthy⁴ suggested that there may be increased stability of the ramal height correction due to gradual adaptation of the pterygo-mandibular sling (muscles of mastication, subcutaneous tissue and skin) during ramal lengthening distraction. McCormick⁵ also suggested there may be beneficial condylar changes in response to local forces applied by the distraction device as the condyle responds to functional loads. Intra-oral distractors were chosen because they are accepted by patients more readily than external distractors.

CT scans and stereolithographic model.

The oral and maxillofacial surgeon requested removal of the appliances before CT scans were taken so that scatter did not produce streak artefacts (Figure 11). A stereolithographic skull model was then constructed



Figure 8 Case report 2: pre-treatment photographs

(Figure 12) to aid pre-operative contouring of the distractors to the right vector.

Treatment progress

Once the patient was reassessed and a joint orthodontic-surgical treatment plan had been formulated, pre-adjusted Edgewise brackets and bands (0.022×0.028 -inch slot, Roth prescription) were placed on all fully erupted teeth in both arches with the exception of

the second molars. Re-alignment was commenced with upper and lower 0.016×0.022 -inch super-elastic nickel titanium arch wires and then 0.019×0.025 -inch super-elastic nickel titanium arch wires were used as the transition to 0.019×0.025 -inch stainless steel arches. Once in these arch wires an anterior root torquing (ART) auxiliary was included to further increase the incisor overjet (Figure 13). After 6 months the patient was ready for the first surgical procedure. In expectation of a post-operative restriction in mouth opening, an



Figure 9 Case report 2: pre-treatment orthopantomogram



Figure 10 Case report 2: pre-treatment lateral cephalogram

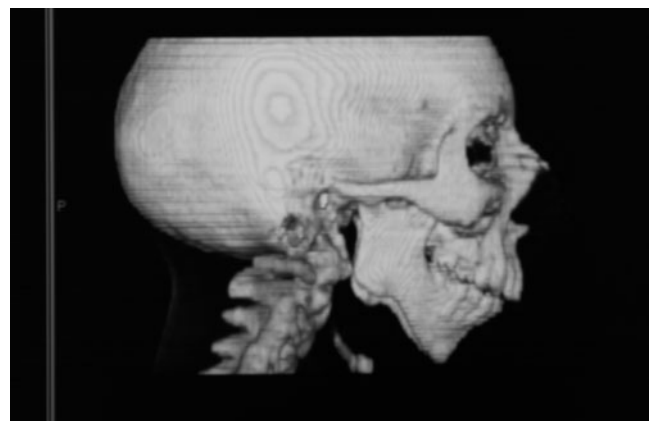
impression was taken of the upper arch, to allow for future wafer construction post-distraction to maintain the lateral open bites created. In addition, interproximal hooks were placed to allow for the application of elastics post-operatively as required.



Figure 12 Case report 2: pre-treatment stereolithographic skull



(a)



(b)

Figure 11 Case report 2: pre-treatment CT scans



Figure 13 Case report 2: anterior root torquing (ART) auxiliary to increase the incisor overjet

After placement of the mandibular paediatric intra-oral distractors (Figure 14) a panoramic radiograph was taken prior to discharge to confirm the position of the distractors. Distractor activation was commenced 5 days post-operatively, and the patient was followed up both clinically and radiographically to confirm symmetrical vertical osteotomy site separation over the 3-week period of distraction. At the end of the phase of activation, it was evident that the anticipated large lateral open bites had not occurred so that it was not necessary to fit a clip-over wafer during the bone consolidation phase. At this point, there was a negative overjet of 3 mm. The patient was then reviewed 1 month after activation had ceased, when it was noted that there had been some antero-posterior and vertical mandibular relapse, with an increase in the ANB value of 1.5° and a loss of 5.5 mm of the 13 mm of posterior facial height gained during the period of distraction (Figure 15). After discussions with the patient and the oral and maxillofacial surgeon, it was decided to adopt a more conservative approach, avoiding further bimaxillary surgery and, instead, completing management with a final procedure to remove the distractors and perform an advancement genioplasty. This was undertaken



Figure 14 Case report 2: placement of mandibular paediatric intra-oral distractors

4 months after initial distractor placement. During the final 4 months of active treatment the occlusion was detailed using finishing bends in 0.016-inch stainless steel arch wires and intra-oral settling elastics. The appliances were removed 18 months after placement, and upper and lower Hawley retainers were fitted (Figure 16). Cephalometric superimposition demonstrates that the skeletal antero-posterior base discrepancy improvement has been minimal with an overall reduction in the ANB value of 1° . However, there has been an increase in mandibular length and lower anterior face height and the genioplasty has improved the chin prominence (Figure 17).

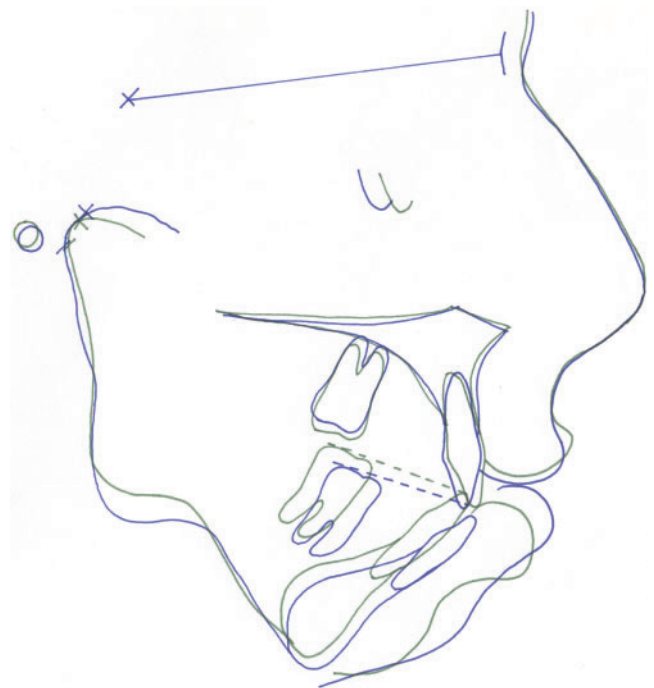


Figure 15 Case report 2: cephalometric superimposition showing vertical and antero-posterior mandibular relapse 6 weeks after activation had ceased (immediately post-distraction, blue; 6 weeks later, green)

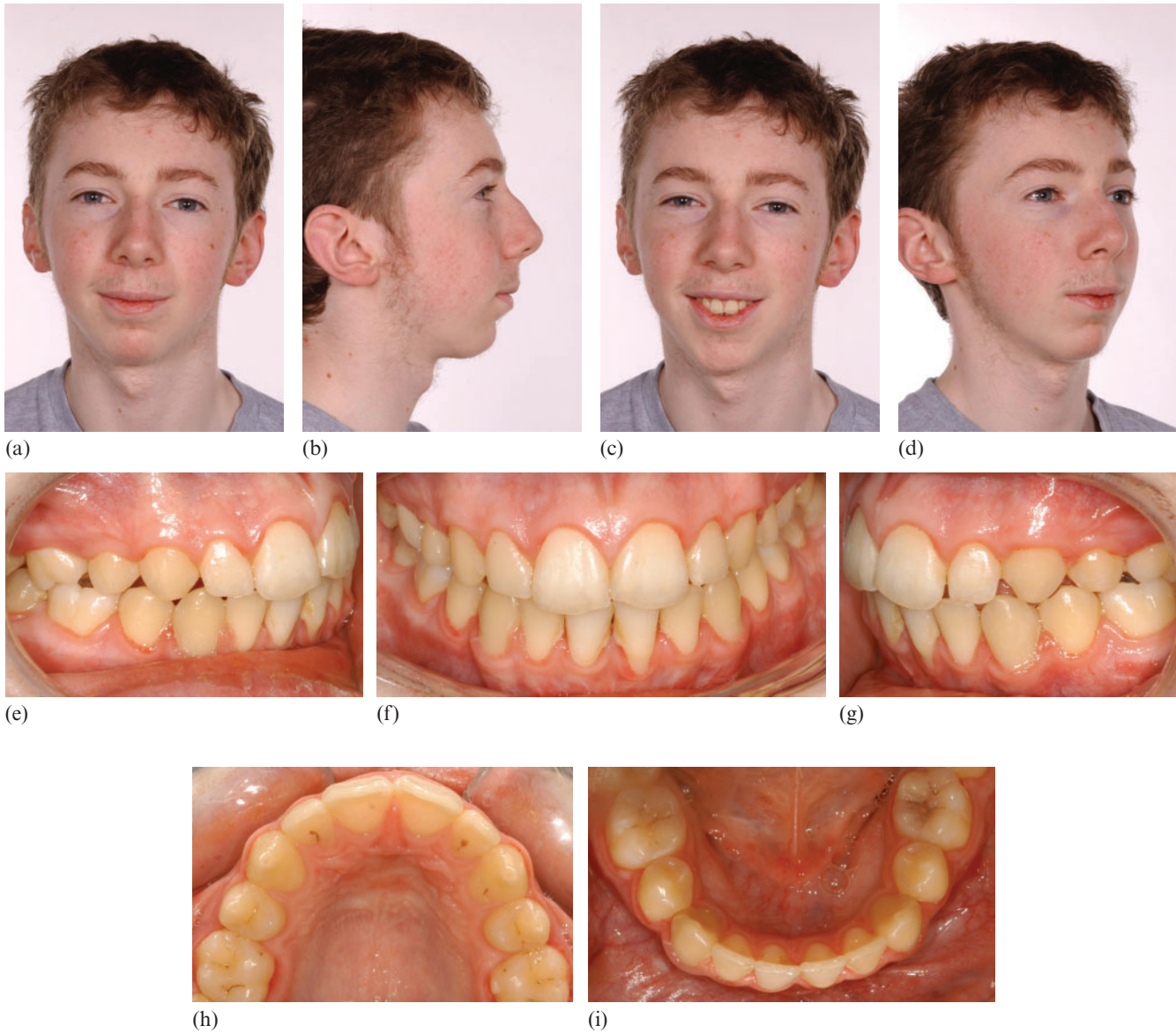


Figure 16 Case report 2: post-treatment photographs

Case 2 assessment

At presentation the patient already had a compromised malocclusion in view of his previous extractions and condylar resorption. Following the cessation of distractor activation there was some unanticipated vertical mandibular relapse, which meant that the anticipated lateral open bites were not as great as expected. This may have been due to inadequate fixation of the distractors in the bone adjacent to the crypts of the lower third molars. Despite this, reasonable antero-posterior correction was achieved and in view of the condylar resorption and the patient's desire to complete treatment as soon as possible, further orthognathic surgery was not deemed appropriate. An advancement

genioplasty at the time of distractor removal gave a significant improvement in facial profile with an increased lower anterior face height and chin prominence. The patient was pleased with the outcome and with the 18 month treatment time. The result had remained stable at 12 months review.

The post-treatment PAR score is 2, which demonstrates a 91% reduction in weighted PAR score.

Acknowledgements

I would like to thank all my supervisors at the Royal Surrey County Hospital, Guildford and the Eastman Dental Hospital, London, for the assistance and training I received during the period of my Fixed Term Training

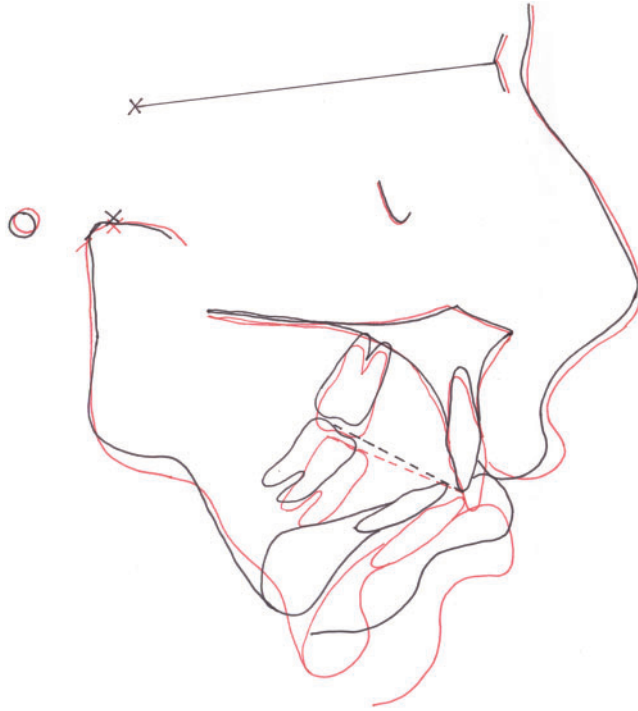


Figure 17 Case report 2: pre- (black) and post-treatment (red) cephalometric superimposition

Appointment, in particular to Mr Nigel Geoffrey Taylor who supervised these two cases and Mr Paul Johnson who performed the surgery in the second case. I would also like to thank American Orthodontics for their generous sponsorship of this prize.

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