Journal of Orthodontics/Vol. 28/2001/257–266

Clinical Section

The BSSO M.Orth Prize of the Royal College of Surgeons of England 1999

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Abstract. *This paper describes the clinical orthodontic treatment of two cases that were awarded the British Orthodontic Society Membership in Orthodontics Prize.*

Index words: BSSO M.Orth Prize, Class II treatment, Class III treatment.

Introduction

This award was established in 1988, the first year in which the Membership in Orthodontics was examined at the Royal College of Surgeons of England. It was presented to the college by the British Society for the Study of Orthodontics. A medal and certificate are presented to the candidate who obtains the highest overall mark in Part II of the M.Orth examination. The prize is only awarded if the examiners believe the candidate's performance is of a sufficiently high standard.

The examination included a long clinical case, diagnostic tests, oral examinations, a written paper, and the presentation of three personally-treated, fully documented cases on which the candidate was examined orally. Details of two of the treated cases are presented in this paper.

Case report 1

Initial presentation

A 13-year 2-month-old Caucasian female was referred by her General Dental Practitioner. She was not happy with the prominence of her upper incisors. The medical history was clear.

Clinical examination (Figure 1a–g)

Extra-oral features. She had a moderate Class II profile with mandibular retrognathia. The FMPA and lower anterior face height were increased. Her lips were incompetent at rest with the lower lip trapped behind the upper incisors. Both lips were slightly forward of the 'E' plane and the naso-labial angle was average. No temperomandibular joint symptoms or signs were noted.

Intra-oral features. The oral hygiene and general dental condition were good, with healthy periodontal tissues. She was in the late mixed dentition with the upper left second deciduous molar retained. An adaptive tongue to lower lip posture was present on swallowing.

Intra-arch features. The lower arch had significant crowding with vertical impaction of the right canine. The right second molar was partially erupted and mesio-angularly impacted. In the upper arch, the teeth were irregular and crowded with significant proclination of the upper central incisors. The patient gave a history of thumb sucking until the age of 8 years.

Inter-arch features. The incisor relationship was Class II division 1 with an overjet of 12 mm and a deep, but incomplete overbite. The upper centreline was correct to the facial midline, whilst the lower was 2·5 mm to the right. The molar relationship was ½ unit Class II on the right and ¾ unit Class II on the left.

Radiographic report

The orthopantomogram confirmed the presence of all permanent teeth (Figure 2). It also confirmed the mesio-angular impaction of both lower second molars, the impaction being worse on the right side. The upper anterior occlusal radiograph showed the upper incisors to have normal root morphology.

Pre-treatment cephalometric interpretation (cephalometric data is given in Table 1.) The SNB angle confirmed the clinical impression of moderate mandibular retrognathia. The ANB angle and Wits analysis indicated a moderate Class II skeletal pattern. The upper incisors were significantly proclined as could be expected following a digit sucking habit. The inter-maxillary planes angle and anterior facial height ratio were both mildly increased (Figure 3).

Aetiology. This malocclusion had a multi-factorial aetiology. The Class II skeletal pattern has contributed to the post-normal buccal segment relationship. The digit habit and subsequent lower lip trap and adaptive swallowing pattern resulted in proclination of the upper incisors and dentoalveolar disproportion has contributed to the crowding. The lower centreline shift and impaction of the lower right canine are probably due to early loss of some of the primary dentition.

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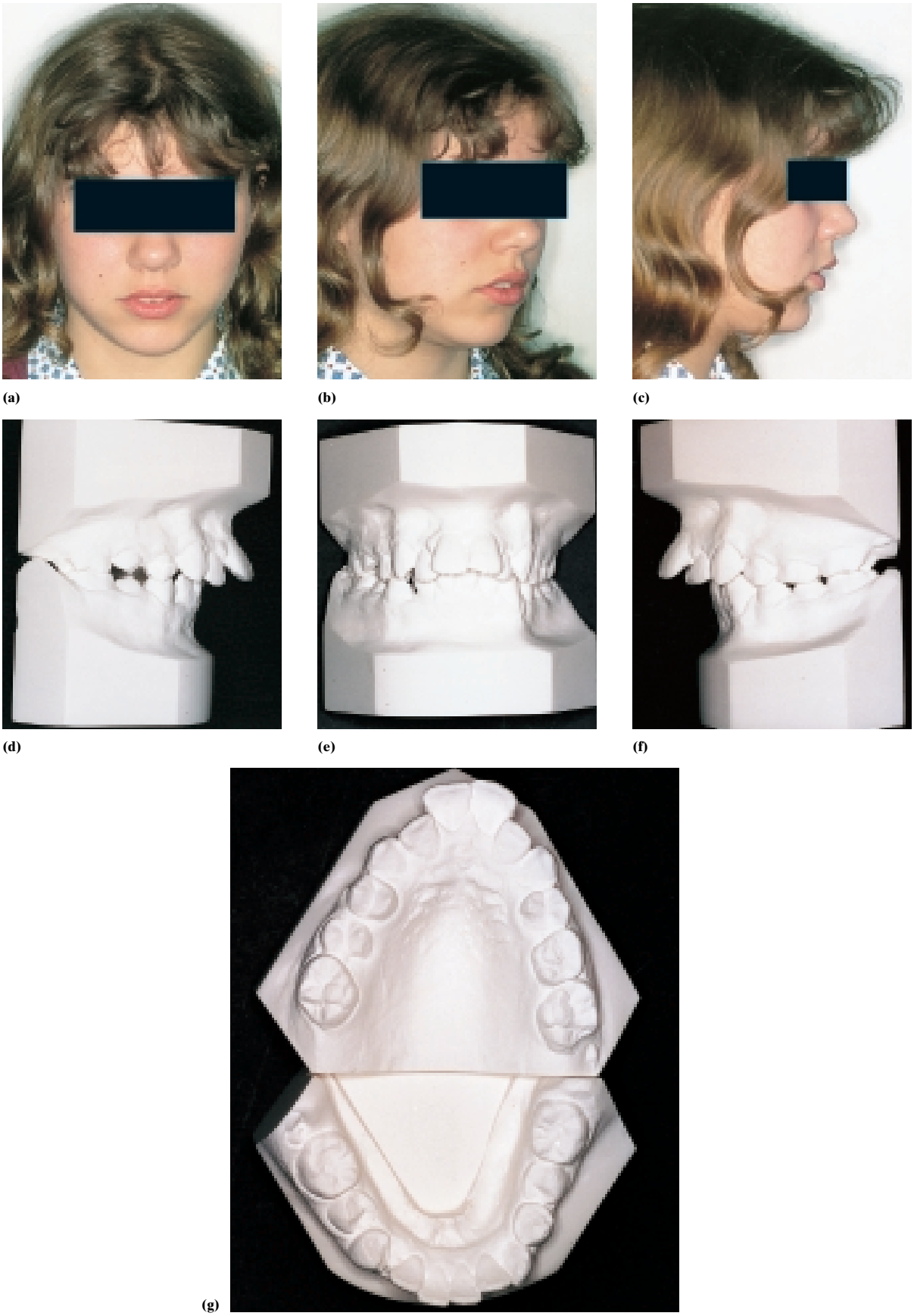


FIG. 1 Case 1: start of treatment.

Aims and objectives of treatment

1. Relief of crowding in the upper and lower arches.
2. Correction of the sagittal discrepancy.
3. Alignment and levelling within arches.
4. Correction of the incisor relationship to Class I.
5. Correction of the centreline discrepancy.
6. Create a functional buccal occlusion.
7. Obtain lip competency.

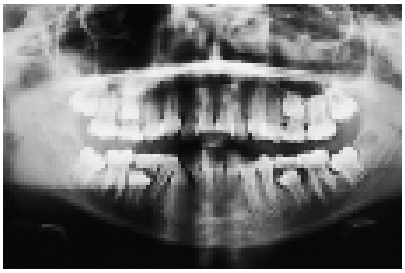


FIG. 2 Orthopantomogram of case 1.

FIG. 3 Lateral cephalogram of case 1.

Space analysis

The Royal London Hospital Space Analysis (Kirschen *et al*., 2000*a* and 2000*b*) was used to determine the space requirements of the case and to help plan treatment mechanics (see Table 2).

Treatment progress

Oral hygiene and dietary advice were reinforced. The four first premolars were then extracted to relieve the crowding and allow the lower right canine to erupt. A modified cribbed activator functional appliance (Figure 4) was fitted, and was worn almost full time for approximately 6 months until anteroposterior correction of incisor and molar relationships was obtained. The design of the functional appliance

TABLE 2 *Royal London Hospital Orthodontic Space Analysis for case 1*

Space requirements	Lower	Upper
Crowding	–10 mm	–1 mm
Levelling occlusal curve	–1 mm	0 mm
Arch width change	0 mm	+2 mm
Incisor A/P change	0 mm	–20 mm
Angulation/inclination change	0 mm	+2 mm
Total	–11 mm	–17 mm
Space creation		
Extraction of four first premolars	+14 mm	+14 mm
Molar relationship change		
Mesial movement	–3 mm	
Differential max/mand growth*		+3 mm
Residue (zero for Class I molars)	0 mm	0 mm

+, Space available or gained; –, space required or lost.
*Mediated by the functional appliance/headgear/favourable growth.

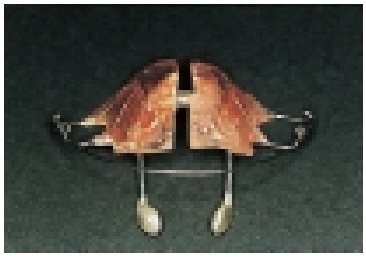


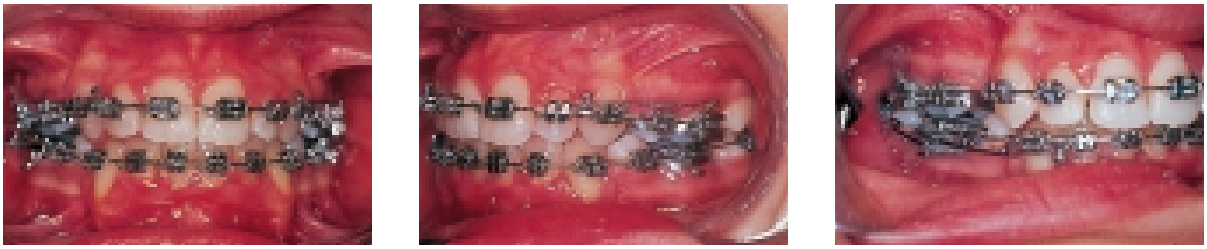
FIG. 4 Modified cribbed activator functional appliance.

TABLE 1 *Cephalometric analysis for case 1*

Variable	Normal	Pre-treatment	Post-treatment	Treatment change
Sella–nasion–A point angle	82 ± 3	81	81	0
Sella–nasion–B point angle	79 ± 3	74	76	+2
A point–nasion–B point angle	3 ± 1	7	5	–2
WITS appraisal	0 mm	+3·5	–1	–4·5
Upper incisor to maxillary plane angle	108 ± 5	125	108	–17
Lower incisor to mandibular plane angle	92 ± 5	93	96	+3
Inter-incisal angle	133 ± 10	108·5	125	+16·5
Inter-maxillary plane angle	27 ± 5	33·5	31	–2·5
LAFH/TAFH (%)	55%	57	57	0
Lower incisor to A point–pogonion line	0–2 mm	+2	+2·5	+0·5
Lower lip to Ricketts' E line	–2 mm	+0·5	0	–0·5

*Lower anterior face height to total face height ratio.
Source of normal values: Wits, Jacobson (1975); others, Houston *et al.* (1992).

allowed the lower pre-adjusted Edgewise fixed appliance (Andrew's prescription brackets and Roth prescription bands) to be placed 2 months into the first phase of treatment. Utilizing continuous archwire mechanics with a 0·022-inch slot allowed early alignment of the lower right canine and control of the overbite. The upper fixed appliance was placed on completion of the A–P correction. Highpull headgear was then fitted to molar bands and worn on a night-time basis. Space was closed on 0·019 × 0·025-inch stainless steel archwires. Once space closure was almost



(a) (b) (c)

FIG. 5 Case 1: pre-adjusted Edgewise appliance.

(a) (b) (c) (d)

(e) (f) (g)

(h) (i)

FIG. 6 Case 1: end of treatment.

complete the lower second molars were picked up. Uprighting of the right second molar required the use of an auxillary spring made of 0·017 × 0·022-inch stainless steel. Asymmetric inter-maxillary elastics were then worn for a short period towards the end of treatment to allow final correction of the centrelines. A lower finishing archwire of 0·018-inch stainless steel was used with artistic bends to correct slight rotations in the canines (Figure 5a–c). On debond an upper Hawley appliance was fitted with Adams clasps on first molar teeth and a long looped labial bow soldered to the clasp bridges. A bonded retainer of 0·0175-inch Twistflex wire was used in the lower arch. The removable retainer was worn full time for 3 months and then nights only.

Total active treatment time was 2 years and 2 months, and the final occlusion is shown in Figure 6a–i.

Assessment of cephalometric changes (see Figures 7 and 8). The skeletal pattern became less Class II with forward movement of B point, which was reflected in reduction in the ANB and Wits values. The incisor and inter-incisal angulations finished within the normal range for Caucasians. The inter-maxillary planes angle reduced during treatment by 2·5 degrees and the use of highpull headgear to control the vertical dimension may have contributed to this.

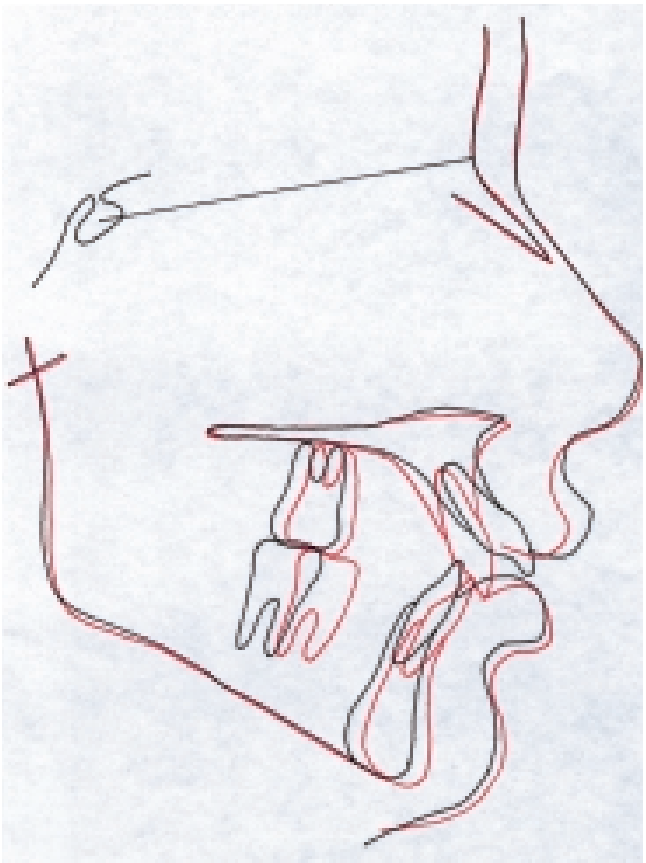


FIG. 7 Case 1: cephalometric tracings superimposed along sella–nasion line, centred at sella.

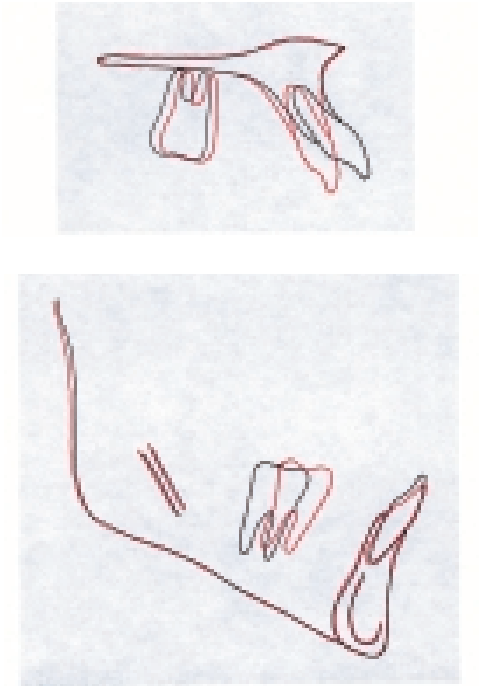


FIG. 8 Case 1: cephalometric superimposition of maxilla and mandible on stable structures.

Occlusal indices

Index of Orthodontic Treatment Need

Dental Health Component:	Start: 5a	Finish: 2g

Peer Assessment Rating

PAR Score:	Start: 49	Finish: 2
	Change: 47	
	(95·9%; greatly improved)	

Analysis of treatment

The functional appliance was successful due to a combination of favourable mandibular growth and dento-alveolar change. The advantage of the particular design of appliance used in this case was that it enabled early placement of the lower fixed appliance, as it was acknowledged that this arch would take longer to treat due to the deep overbite and impacted teeth. Before treatment, the lower lip functioned inside the upper incisors. At the end of treatment the upper incisors were within control of the lower lip, which is important for stability of the overjet reduction.

Case report 2

Initial presentation

An 11-year 10-month-old Caucasian male was referred by his General Dental Practitioner with concern about the gaps between his upper teeth. The medical history was clear and the family history revealed that his grandfather had a skeletal III jaw relationship.

FIG. 9 Case 2: start of treatment.

Clinical examination (Figure 9a–h)

Extra-oral features. He had a mild Class III profile with mandibular prognathism. The lower anterior face height and Frankfort mandibular plane angle were slightly increased. The lips were apart at rest and the naso-labial angle was normal. No temperomandibular joint symptoms or signs were noted.

Intra-oral features. Oral hygiene was generally satisfactory, except around the instanding lateral incisors. He was in the early permanent dentition, but the upper canines were unerupted and the periodontal tissues were healthy.

Intra-arch features. The lower arch was broad with mild crowding, mesio-labial rotation of the lower canines and retroclination of the lower incisors. The upper arch was comparatively narrow with severe crowding and both upper canines were buccal to the line of the arch and the upper central incisors were mildly proclined. The Bolton tooth size analysis showed mild mandibular labial segment excess of 1·5 mm.

Inter-arch relationships. The incisor relationship was Class III with upper central incisors overjet of 1 mm and the upper lateral incisors in crossbite. The overbite was reduced, but complete and the centrelines were coincident with the facial midline. The molar relationships were Class I on the left and half unit III on the right. The right buccal segment was in crossbite but there was no detectable mandibular displacement on closure.

Radiographic report

The orthopantomogram confirmed the presence of all permanent teeth (Figure 10). The upper canines appeared favourable for alignment. The upper anterior occlusal radiograph showed the upper incisors to have normal root morphology. Cephalometric data is given in Table 3.

Pre-treatment cephalometric interpretation (Figure 11). Mandibular prognathism is suggested by the SNB angle of 83 degrees. The inter-arch anteroposterior relationship was mildly Class III according to the ANB value (ANB of 2 degrees corrected to 0·5 degree using the Eastman correction) and the Wits analysis. The anterior facial height ratio was increased and this was mirrored by an increase in the inter-maxillary planes angle. The upper incisors were mildly proclined and the lower incisors retroclined suggesting that some dental compensation had already taken place for the underlying skeletal III pattern.

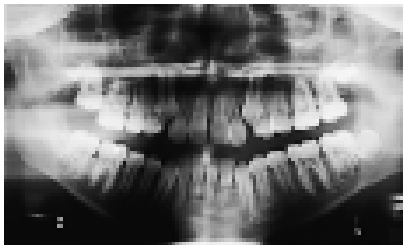


FIG. 10 Orthopantomogram of case 2.

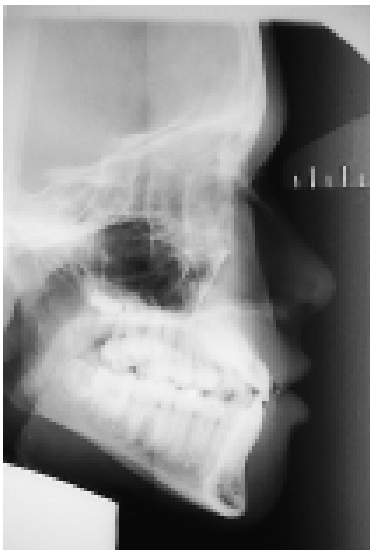


FIG. 11 Lateral cephalogram of case 2.

Aetiology. This malocclusion has resulted from the skeletal III basal relationship and dentoalveolar disproportion.

Aims and objectives of treatment

1. Correction of the posterior crossbite and relief of crowding by expansion of the upper arch.
2. Alignment of the maxillary canines.
3. Create a positive overjet for the upper incisors and maintain a positive overbite.
4. Create a functional buccal occlusion

Space analysis

The Royal London Hospital Space Analysis (Kirschen *et al*., 2000*a* and 2000*b*) was used to determine the space requirements of the case and to help plan treatment mechanics (see Table 4).

Treatment progress

Oral hygiene instruction and dietary advice was undertaken over a number of visits. He was warned of the possibility of unfavourable growth making orthodontic

TABLE 4 *Royal London Hospital Orthodontic Space Analysis for case 2*

Space requirements	Lower	Upper
Crowding	–3 mm	–8 mm
Levelling occlusal curve	0 mm	0 mm
Arch width change	0 mm	+4 mm
Incisor A/P change	0 mm	+3 mm
Angulation/inclination change	0 mm	+1 mm
Total	–3 mm	0 mm
Space creation		
Tooth reduction*	+3 mm	0 mm
Residue (zero for Class I molars)	0 mm	0 mm

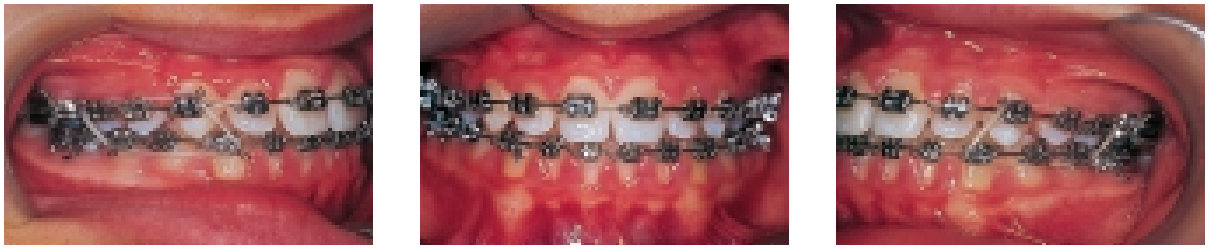
+, Space available or gained; –, space required or lost.
*Inter-dental enamel stripping of the lower labial segment.

TABLE 3 *Cephalometric analysis for case 2*

Variable	Normal	Pre-treatment	Post-treatment	Treatment change
Sella–nasion–A point angle	82 ± 3	85	86	+1
Sella–nasion–B point angle	79 ± 3	83	85	+2
A point–nasion–B point angle	3 ± 1	2	1	–1
WITS appraisal	0 mm	–8	–4	+4
Upper incisor to maxillary plane angle	108 ± 5	116	121	+5
Lower incisor to mandibular plane angle	92 ± 5	82	83	+1
Inter-incisal angle	133 ± 10	131	126	–5
Inter-maxillary plane angle	27 ± 5	31	30	–1
LAFH/TAFH (%)	55%	57	57·5	+0·5
Lower incisor to A point–pogonion line	0–2 mm	+4	+6	+2
Lower lip to Ricketts' E line	–2 mm	+2	+3	+1

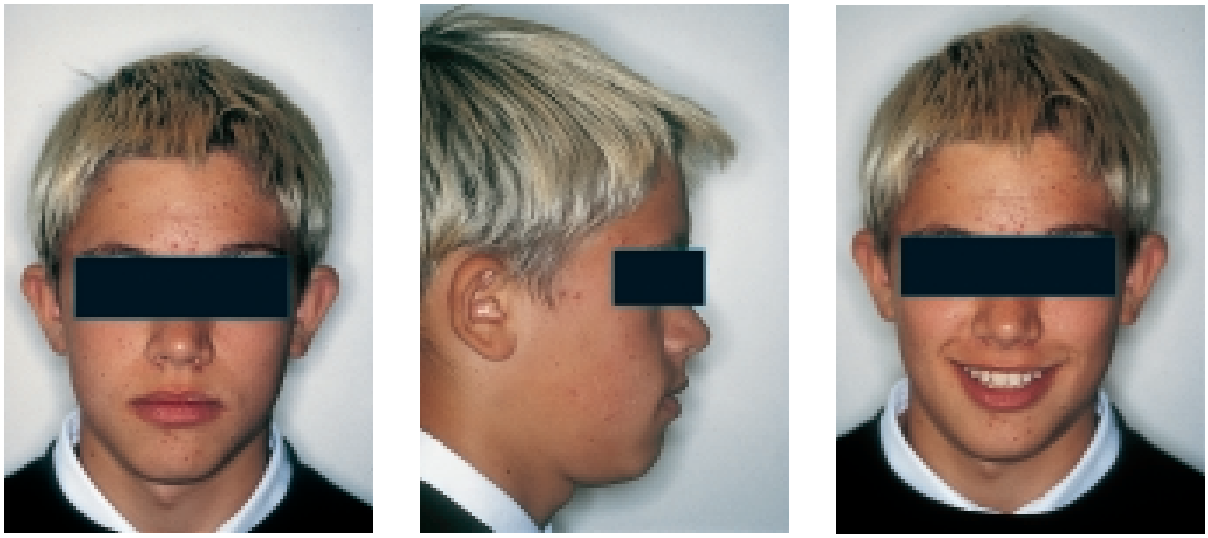
Source of normal values: Wits, Jacobson (1975); others, Houston *et al*. (1992).

camouflage impossible. Initial efforts were aimed at crossbite correction and upper arch alignment, whilst monitoring mandibular growth. A quadhelix appliance was used to expand the upper arch and the arms were extended forwards on to the lateral incisors to procline these teeth. The buccal crossbite was corrected within 4 months. At that stage the upper arch was bonded with 0·022 × 0·028-inch Andrew's prescription pre-adjusted Edgewise brackets. A



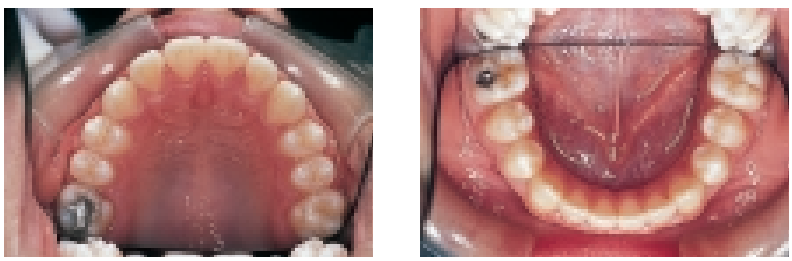
(a) **(b)** **(c)**

FIG. 12 Case 2: pre-adjusted Edgewise appliance.



(a) **(b)** **(c)**

(d) **(e)** **(f)**



(g) **(h)**

FIG. 13 Case 2: end of treatment.

0·014-inch super-elastic nickel titanium archwire was used to gain initial alignment and once a 0·018-inch stainless steel archwire could be placed, coil springs were used to open up space for the canines.

It was then decided to bond the lower arch and contralateral brackets were used on the lower canines to reduce the risk of proclination of the lower incisors. Inter-dental stripping was carried out in the lower labial segment to relieve the mild crowding there. The upper canines erupted spontaneously once sufficient space had been created. These teeth were picked up by dropping down to a light nickel titanium archwire. Once a rectangular stainless steel wire could be placed in the upper arch the quadhelix was removed to allow full co-ordination of the arches and the placement of progressive buccal root torque in the upper buccal segments. Labial root torque was added to the archwire in the region of the upper lateral incisors as they had been instanding at the start of treatment. The case was finished on upper 0·019 × 0·025-inch and lower 0·020-inch round stainless steel archwires (Figure 12a–c). Light Class III elastics were used towards the end of treatment to ensure a good buccal segment relationship and to maximize incisor camouflage. On debond upper Hawley and lower bonded retainers were placed. The removable retainer was worn full time for 6 months and then nights only. Total active treatment time was 19 months and the final occlusion is shown in Figure 13a–h).

Assessment of Cephalometric Changes (see Figures 14 and 15)

There was forward growth of the maxilla and mandible relative to the cranial base, as assessed by SNA and SNB. The ANB angle became 1 degree more negative suggesting unfavourable growth. In contrast the Wits analysis became more positive, probably as a result of the Class III elastics causing canting of the occlusal plane in an anti-clockwise direction. The vertical skeletal relationships were virtually unchanged. The upper incisors became more proclined and the lower incisors maintained their pre-treatment inclination, thereby compensating for the underlying skeletal III bases.

Occlusal indices

Index of Orthodontic Treatment Need

Dental Health Component:	Start: 5i	Finish: 2g

Peer Assessment Rating

PAR Score:	Start: 43	Finish: 2
	Change: 41	
	(95·3%; greatly improved)	

Analysis of treatment

Growth in patients who have a Class III skeletal pattern is unpredictable. Hence, treatment started with the aim of correcting the crossbite by upper arch expansion and creating space for the maxillary canines, whilst monitoring mandibular growth. It was then decided to bond the lower arch to gain alignment and allow use of Class III elastics to maximize dental camouflage. Lower arch extractions are not usually wise in a Class III patient who may still be a candidate for orthognathic surgery, and hence the lower labial segment was stripped inter-dentally to relieve the mild crowding. The end of treatment overbite was normal and complete, which is important for the stability of the anterior crossbite correction. Full posterior crossbite correction was achieved with good buccal overlap and inter-cuspation of the buccal segments. At debond the patient

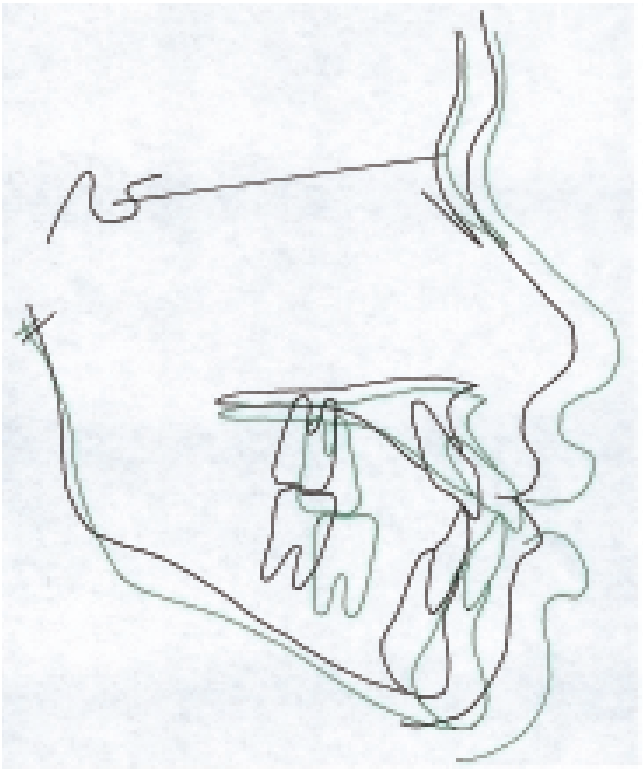


FIG. 14 Case 2: cephalometric tracings superimposed along sella–nasion, centred at sella.

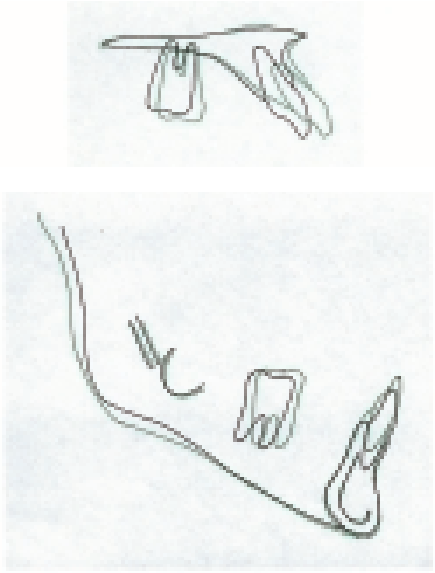


FIG. 15 Case 2: cephalometric superimposition of maxilla and mandible on stable structures.

was still only 13·5 years of age and, hence, it will be important to monitor future facial growth.

Acknowledgements

I would like to thank all my clinical supervisors at the Royal London Hospital and Whipps Cross Hospital for their excellent teaching. I would especially like to thank Mr Robert Lee and Mrs Margaret Collins who supervised these cases.

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