Clinical Section

The William Houston Gold Medal 1995

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Introduction

The William Houston Gold Medal is presented to the candidate achieving the most outstanding and meritorious performance in both theoretical and clinical aspects of the M.Orth. examinations in any year of the Royal College of Surgeons of Edinburgh. Five clinical cases (two comprehensive and three condensed presentations) treated by the candidate are presented for the purposes of the examination; two of these cases are described below. The first is a high angle Class II division I malocclusion with severe crowding (comprehensive presentation); the second is a Class II division II case treated by a combination of orthodontics and orthognathic surgery (condensed presentation).

William Houston Medal awarded for most outstanding performance in the M.Orth, R.C.S.(Ed.) Examination.

Case Report 1

A 14·5-year-old Caucasian female presented complaining of the appearance of her crooked front teeth. (Fig. 1a–i). Her medical history was unremarkable and her co-operation assessed to be good by her referring General Dental Practitioner where she was a regular attender.

Extra-oral clinical examination revealed a mild Class II, slightly convex profile, with an increased Frankfort-mandibular planes angle and an increased lower to total anterior face height ratio. Transversely, there was no facial asymmetry or lateral mandibular displacement. The lips were mildly incompetent and habitually held together. Tongue activity, speech and mandibular function were normal, and there was no history of digit sucking.

Intra-orally, she presented in the permanent dentition with all teeth present apart from third permanent molars.

Mouth care was generally good, but with some improvement in oral hygiene required. Examination of the dental arches revealed mild crowding in the lower labial segment and moderate–severe crowding of the upper labial segment with $\underline{2}|\underline{2}$ palatally positioned. In the lower buccal segments there was severe crowding localised to the canine and premolar areas with $\overline{3}|\overline{3}$ buccally excluded and very mesially angulated. The upper buccal segments displayed severe crowding with $|\underline{3}$ completely excluded buccally and $|\underline{24}$ in contact; and $\underline{3}|$ also buccally displaced.

In occlusion, the overjet measured 6 mm, the overbite was reduced and incomplete and there was a cross-bite present affecting $|\underline{2}$. This produced a displacement. The upper centreline was displaced to the left of the mid-facial plane and the lower centreline displaced to the right with a total midline discrepancy of 4·5 mm. The molar relationship on the right side was Class III and on the left, Class I; with the canines on the right side a quarter unit Class II and the left side Class II.

The panoramic radiograph confirmed the presence of all permanent teeth.

Cephalometric analysis (Table 1 and Fig. 1i)

Using an Eastman correction to the Steiner analysis, the ANB angle was 6 degrees which suggests a Class II skeletal base. McNamara's analysis supports this assumption. However, the Wits analysis was 0 mm which indicates Class I. The Harvold analysis indicates that the maxillary and mandibular unit lengths approximate to the normal values for the patient's age. However, the anterior vertical dimension is significantly increased. The maxillary-mandibular planes angle was at the upper limit of the normal range at 32 degrees. The increased *Y* axis measurement of 67 degrees, the Jarabak ratio of 61 per

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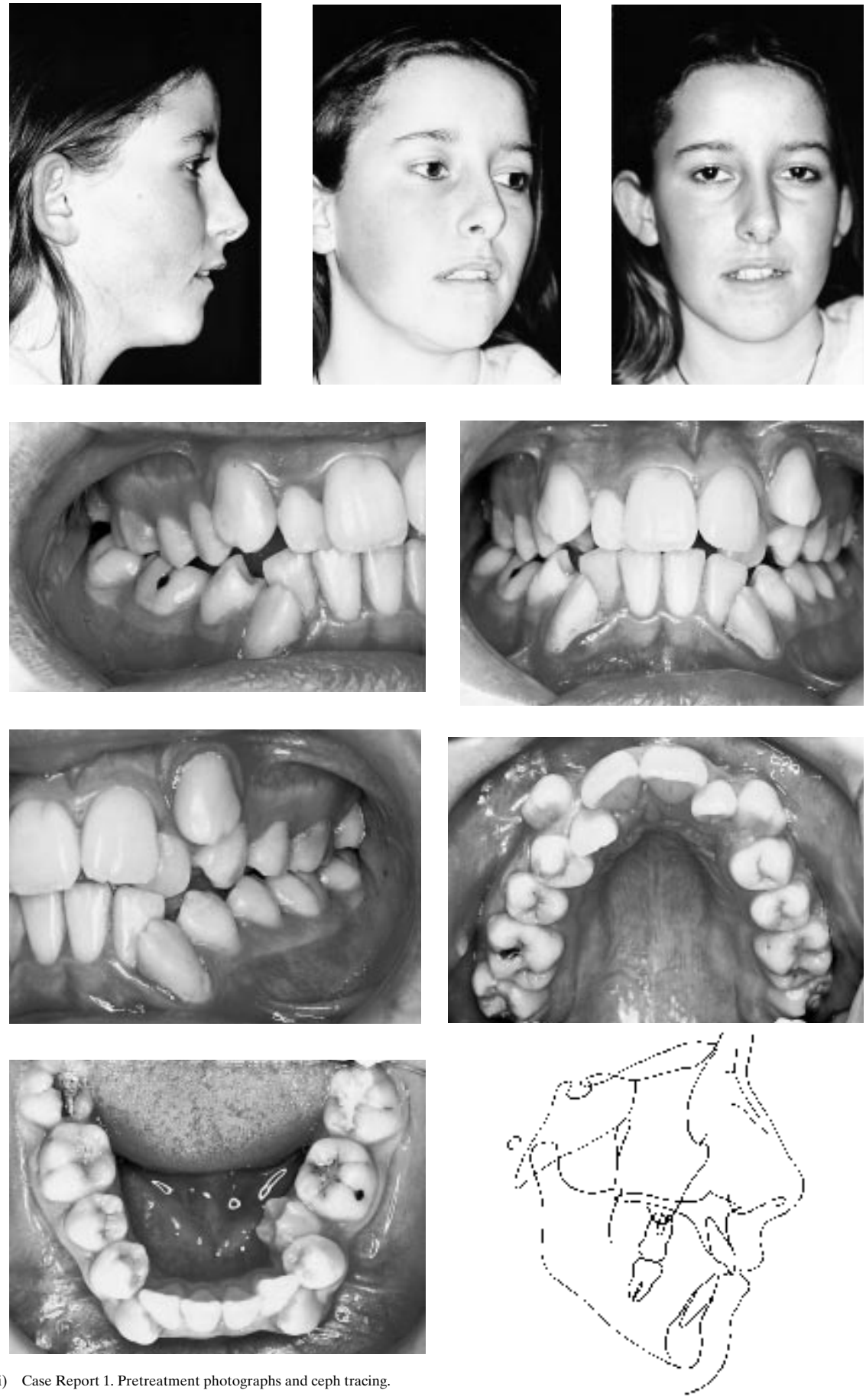

FIG. 1(a–i) Case Report 1. Pretreatment photographs and ceph tracing.

TABLE 1 *Case report 1. Pre- and post-treatment*

	Pre-treatment	Post-treatment
SNA (degrees)	80	79
SNB (degrees)	75	75
ANB (degrees)	5 (6)	4 (5.5)
MMPA (degrees)	32	31
Lower face height (as a % of total face height)	55	54
Bjork's facial polygon (sum of angles) (degrees)	406	403
Posterior face height to anterior face height ratio (Jarabak) (per cent)	61	62
Y-axis (degrees)	67	66
SN to maxillary plane (degrees)	12	12
SN to Frankfort plane (degrees)	7	7·5
UI to Mx (degrees)	115	112
LI to Mn (degrees)	88	97
SNI (degrees)	78	80
Interincisal angle (degrees)	125	120
LI to A-Pog plane (mm)	0	+4
Wits analysis	BO and AO coincident	−1·5 mm
Upper lip to aesthetic plane (mm)	−3	−4
Lower lip to aesthetic plane (mm)	−5	−6

cent and the value for Bjork's polygon at 406 degrees, all support the clinical impression of an increased vertical dimension to the skeletal pattern. The upper incisors were mildly proclined at 115 degrees to the maxillary plane. The lower incisors, measured at 88 degrees to the mandibular plane, were at normal inclination when one considers the increased maxillary-mandibular planes angle of 32 degrees.

The aims of treatment were as follows:

(1) improve oral hygiene;
(2) relief of crowding in the upper and lower arches within the zone of soft tissue balance;
(3) reduce the overjet and maintain (or increase) the tenuous overbite to create a Class I incisor relationship;
(4) correct the centrelines;
(5) correct the crossbite $\underline{2}|$ and eliminate the forward mandibular displacement;
(6) produce a Class I molar relationship.

The treatment plan was as follows:

(1) Refer to hygienist for oral hygiene and dietary advice.
(2) Place a transpalatal arch $\underline{6}|\underline{6}$ constructed 3 mm away from the palatal mucosa to assist vertical control of the molars. Place a lower lingual arch $\overline{6}|\overline{6}$.
(3) Add high pull headgear to $\underline{6}|\underline{6}$ and confirm co-operation (see Fig. 2a,b).
(4) Request the extraction of all four first premolars by the General Dental Practitioner.
(5) Bond the upper and lower arches with a pre-adjusted edgewise appliance ('A' company, Andrews' non-extraction prescription with 0·022″ × 0·028″ slot) except $\underline{2}|\underline{2}$. Carry out alignment and levelling. Laceback on $\underline{3}|$ and $|\overline{3}$ and use push coils between $|\underline{1}$–$\underline{3}$ and $\overline{3}$–$\overline{1}|$ to aid centreline correction. Allow incisor alignment following canine retraction.
(6) Bond $\underline{2}|\underline{2}$ and $\overline{5}\overline{2}|\overline{2}$; proceed through secondary alignment and levelling with lacebacks to all four canines (Figs. 2a–g).
(7) Place coordinated 0·019″ × 0·025″ stainless steel archwires in upper and lower arches to complete overjet reduction and space closure with torque control.
(8) Detail and finish with appropriate torque control to $\underline{2}|\underline{2}$.
(9) Retain and monitor the development of third molars.

The treatment consisted of a total of 24 visits over 26 months utilizing nickel titanium and stainless steel archwires. Brackets $\underline{2}|\underline{2}$ were bonded inverted to aid root control and active buccal root torque was employed in the working archwire (0·019″ × 0·025″) to position $\underline{652}|$ $|\underline{256}$. All four second molars were included in the late stages of appliance treatment only. Finishing was performed with 0·019″ × 0·025″ TMA and a short period of intermaxillary box elastic wear to seat the occlusion. Upper Begg and lower Hawley removable retainers were used (Figs. 3a–i).

Pretreatment IOTN score (DHC) = 4d

Pretreatment weighted PAR score = 53

Case 1 assessment

The patient has grown predominantly in a vertical direction during treatment. Since the antero-posterior relationship of the skeletal bases was largely unchanged during treatment, there has been little help from horizontal growth in the treatment of the malocclusion (see Fig. 4). Superimposition of the maxillary tracings showed that there has been a combination of palatal tipping and bodily retraction of the upper incisors during overjet reduction. The upper first molar has maintained its anteroposterior position.

Superimposition of the mandibular tracings showed that the inclination of the lower incisors to the mandibular plane has changed during treatment. The incisal

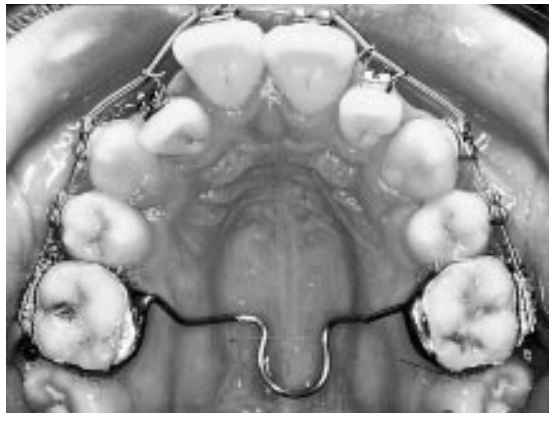

FIG. 2(a–g) Case Report 1. Appliances during treatment.

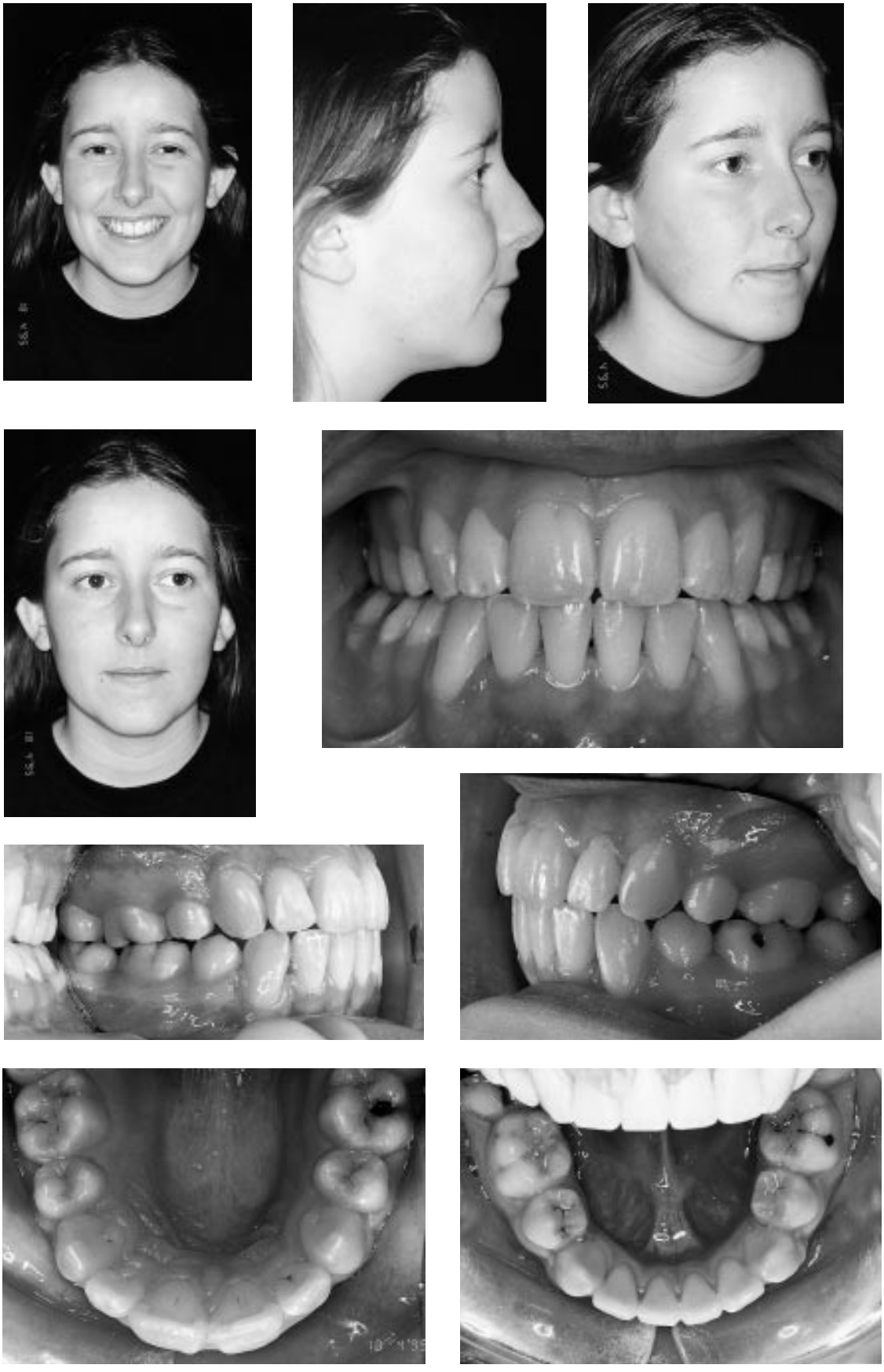

FIG. 3(a–i) Case Report 1. Post-treatment photographs.

FIG. 4 Case Report 1. Pre- (black) and post-treatment (red) ceph tracings superimposed on DeCoster's line.

edges have been advanced (SNI 78 degrees pretreatment and 80 degrees post-treatment; Table 1) as was anticipated and the root apices have been translated distally. The stability of this change is unpredictable since it is not possible to state with certainty that the teeth remain within the zone of soft tissue balance. The molar relationship on the left side has been maintained at Class I and on the right side corrected into a Class I relationship by forward movement of the $\overline{6}|$ relative to the $\underline{6}|$.

The nose has grown downwards and forwards. The lip competence is similar to the pre-treatment finding of a mild incompetence with the lips habitually held together. The upper and lower lips are both slightly further behind the aesthetic plane due to alterations in the soft tissue reference points, nose and chin, for the aesthetic plane.

The overjet has been reduced during treatment, by movement of the upper central incisors and also movement of the lower incisors. The tenuous overbite has been maintained and the buccal segments corrected to a Class I relationship. The long term prognosis for the overbite and lower labial segment alignment must be guarded.

Post-treatment IOTN score (DHC) = 2 g

Post-treatment weighted PAR score = 2

Percentage reduction in PAR score = 96·2 per cent

Case Report 2

This patient presented at the age of 13 years 2 months complaining about her crooked front teeth, with a severe Class II division 2 malocclusion on a Class II skeletal base with significant mandibular retrognathia (Fig. 5a–i). The Frankfort mandibular planes angle and lower anterior face height ratio were reduced. Her lips were competent and everted, with a deep labio-mental fold. Cheryl was in the permanent dentition with all permanent teeth erupted apart from third permanent molars.

Oral hygiene was of a high standard. The dentition was caries free. Severe crowding was present in the lower right quadrant with the $\overline{4}|$ virtually completely excluded buccally. The lower dental centreline was displaced to the right side and the curve of Spee was increased. The overbite was increased and complete against the palatal mucosa with evidence of soft tissue trauma and inflammation. Moderate localized crowding was present in the upper arch with $\underline{2}|$ proclined and excluded buccally and $|\underline{2}$ proclined and mesiolabially rotated. The overjet was 2 mm measured to $\underline{1}|\underline{1}$. The molar relationship was a full unit Class II on the left and three-quarters of a unit Class II on the right. A dental crossbite was present affecting the $\underline{54}|$. There was no displacement of the mandible on closure. The panoramic radiograph confirmed the presence of all permanent teeth.

Pre-treatment IOTN score (DHC) = 4a

Pre-treatment weighted PAR score = 43

Cephalometric Analysis (Table 2 and Fig. 5i)

This confirms:

(1) the Class II skeletal base with mandibular retrognathia;
(2) the reduced vertical dimension;
(3) the upper central incisors were very retroclined at 82 degrees and the lower incisors were at normal inclination.

The aims of treatment were as follows:

(1) To align the upper arch non-extraction and decrowd the lower arch with premolar extractions.
(2) Proclination of the upper central incisors to produce a Class II division 1 incisor relationship.
(3) Co-ordination of arch widths.
(4) Orthognathic surgical mandibular advancement to create a Class I incisor relationship and Class III molar relationship with harmonious facial balance.
(5) Post-operative levelling of the curve of Spee to improve the lower face height ratio.

The treatment plan was as follows:

(1) Band $\underline{6}|\underline{6}$. Bond brackets $\underline{5431}|\underline{12345}$ (pre-adjusted Edgewise appliance; 'A' Company Andrews' non-extraction prescription 0·022″ × 0·028″ slot used throughout).
(2) Commence initial aligning and levelling.
(3) Provide upper removable appliance to allow brackets to be bonded $\overline{54321}|\overline{12345}$.
(4) Utilize push coil mechanics to enable (i) aligning of $\underline{2}|$ and (ii) correction of lower centreline.
(5) Cephalometric re-evaluation of the lower incisor position to establish the choice of first or second premolar extractions in the lower arch.
(6) Correlate the upper and lower arches on co-ordinated 0·019″ × 0·025″ stainless steel archwires.
(7) Arrange for surgical removal of all four third molars.
(8) Surgical mandibular advancement to an over-corrected Class I incisor relationship.

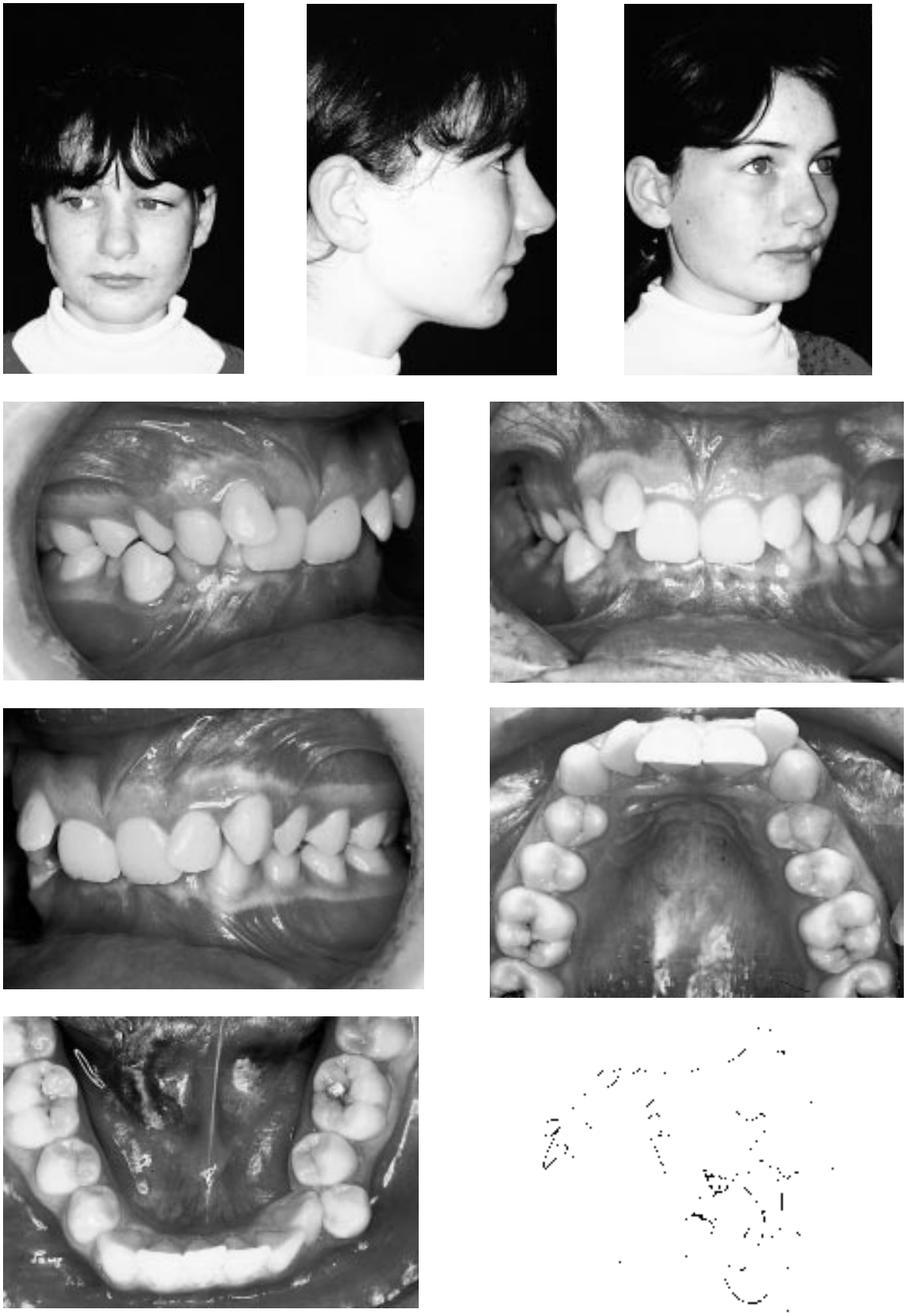

FIG. 5(a–i) Case Report 2. Pretreatment photographs and ceph tracing.

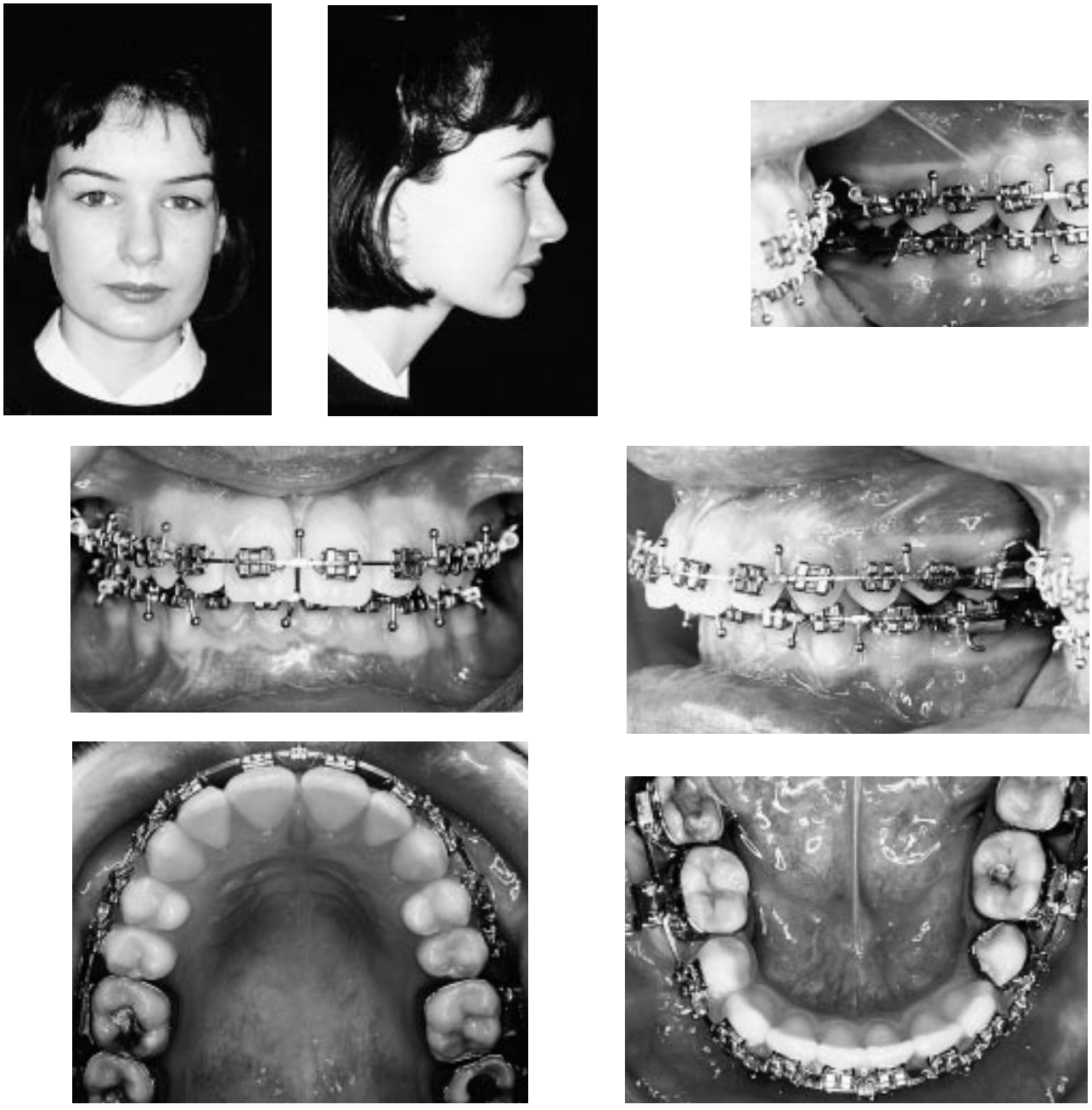

FIG. 6(a–g) Case Report 2. Presurgical photographs.

(9) Final levelling of the curve of Spee utilizing box elastics in the buccal segments to achieve the desired increase in lower face height.
(10) Detail and finish.
(11) Retain and monitor.

Alternative Treatment Options

The patient was considered to have passed the peak velocity of her pubertal growth spurt (at age 13 years 2 months) and growth modification treatment with a functional appliance was, therefore deemed unsuitable. The option of orthodontic tooth movement to camouflage the skeletal discrepancy was considered and discussed. (Extraction of four premolars, headgear and fixed appliances.) It was regarded as a difficult treatment since premolar extractions in the lower arch would be required to decrowd and correct the lower centreline. (Mid-arch extraction is considered unfavourable to the vertical anchorage required for reducing the deep overbite.) In the sagittal plane, considerable anchorage would be required for appropriate torque control to $\underline{1}|\underline{1}$ and correction of the buccal segment relations. The patient refused to wear headgear. After a fully informed discussion, she chose to proceed with orthodontic treatment combined with orthognathic surgery.








FIG. 7(a–g) Case Report 2. Post-treatment photographs.

FIG. 8 Case Report 2. Pre- and post-treatment ceph tracings superimposed on DeCoster's line.

Treatment Progress

Treatment proceeded as described in the treatment plan, utilizing nickel titanium and stainless steel archwires. A Ni-Ti push coil was used to allow alignment of the 2|. Five months into treatment, extraction of $\overline{5}|\overline{5}$ was arranged to provide adequate space for alignment of $\overline{4}|$, and lower centreline correction and appropriate lower incisor position relative to Pogonion. Ni-Ti springs were used in the space closing mechanics. Fifteen months from the start of active treatment presurgical orthodontics was complete (Fig. 6a–g) and a surgical mandibular advancement was performed using a bilateral sagittal split osteotomy technique. Fixation was with bicortical titanium screws. Surgical recovery was uneventful and she was discharged from hospital 2 days post-operatively. A lower 0·017″ × 0·025″ braided stainless steel archwire and red TP inter-maxillary elastics were employed in a triangular arrangement bilaterally attached to Kobyashi ligatures 53|35 to settle the occlusion. Upper Begg and lower Hawley removable retainers were used (Fig. 7a–g).

Case II Assessment

The malocclusion was considered to be severe and the greatest degree of improvement would be achieved by mandibular advancement to correct the underlying skeletal discrepancy, concurrently improving facial aesthetics and the soft tissue profile.

The mandible was surgically advanced into an edge-to-edge incisal relationship and levelling of the curve of Spee was carried out post-surgically in order to increase the lower face height. Following upper arch alignment, the upper incisors were slightly proclined at 118 degrees. However, the application of Class II elastic traction post-surgically leaves the inclination at a normal value of 112 degrees (Fig. 8). The choice of premolar extraction in the lower arch was determined by:

(1) The desired presurgical lower incisor position.
(2) The space requirements for dental alignment, centreline correction and post-surgical levelling of the curve of Spee.

The lower incisors are slightly proclined to the mandibular plane at 100 degrees post-treatment, but this is felt to be a satisfactory position since further retraction of the lower labial segment would have led to excessive mandibular advancement and an unaesthetic facial profile. The nose has grown downwards and forwards during treatment. The lower lip has been advanced to a similar amount as the

TABLE 2 *Case report 2. Cephalometric changes*

	Pretreatment	Presurgery	Post-surgery	Post-treatment
SNA (degrees)	81	81	80	80
SNB (degrees)	74	75	79	79·5
ANB (degrees)	7	6	1	0·5
MMPA (degrees)	20	20	26	25
Lower face height (as a % of total face height)	50	53	56	55
Bjork's Facial Polygon (sum of angles) (degrees)	389	388	400	392
Posterior face height to anterior face height ratio (Jarabak) (per cent)	66	70	66	66
SN to maxillary plane (degrees)	8	8	7	7
SN to Frankfort plane (degrees)	7	7	6	6
Y-axis (degrees)	56	56	59	59
UI to Mx (degrees)	82	118	115	112
LI to Mn (degrees)	92	97	100	100
Interincisal angle (degrees)	166	125	119	123
LI to A-Pog plane (mm)	−6	−4	+1	+2
SNI (degrees)	74	75	81	81
Wits analysis	AO +6 mm anterior to BO	AO +5 mm anterior to BO	BO 2 mm in advance of AO	BO 2 mm in advance of AO
Upper lip to aesthetic plane (mm)	−6	−4	−7	−8
Lower lip to aesthetic plane (mm)	−8	−6	−5	−7

mandibular advancement with concurrent elimination of the unsightly deep labiomental fold and improvement in the nose to chin relationship with the increase in lower face height.

The occlusal relationship has been corrected during treatment to produce a Class I incisor relationship, and Class III buccal segments with reduction of the deep overbite and improvement in facial aesthetics. Although, the overall long-term prognosis should be favourable, the long-term stability of the lower labial segment must be guarded.

Post-treatment IOTN score (DHC) = 2 g

Post-treatment weighted PAR score = 2

Percentage reduction in PAR score = 95·3 per cent.