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Clinical Section

1999 Optident Prize and William Houston Medal of the Royal College of Surgeons of Edinburgh

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Abstract. *This paper describes the clinical orthodontic treatment of three cases which were awarded the 1999 Optident prize and the William Houston Medal.*

Introduction

The William Houston Medal is awarded to the candidate attaining the highest examination performance in the Membership in Orthodontics (M.Orth) for the Royal College of Surgeons of Edinburgh. As part of the final examination the candidate is required to present five treated cases.

The Opident prize is held annually at the British Orthodontic Conference and is open to any postgraduate practitioner passing the M.Orth examination of one of the Surgical Royal Colleges during the preceding year. The prize is awarded for the two most outstanding cases submitted as judged by an 'expert panel', and takes into account the treatment difficulty, as well as the finished occlusion. The cases are normally chosen from the candidates M.Orth presentation cases. For the first time this year's recipient of the William Houston Medal was also the winner of the Optident prize. This report describes the treatment of three M.Orth cases, the first two of which were the Optident prize cases.

Case I

Initial Presentation

The patient presented initially at the age of 12 years 4 months and was considered for active treatment at the age of 14 years exactly. She was concerned by unaesthetic gaps in her upper teeth and the prominence of the lower front teeth. She was not, at this stage, concerned by her prognathic mandible. Her medical history was clear and her family history revealed her father also had a Class III malocclusion.

Clinical Examination

Extra-oral Features (Figure 1). There was a mild Class III profile with mandibular excess. The lower anterior face height and Frankfort mandibular plane angle were minimally increased. There was mild mandibular asymmetry with the chin point to the left. The mid-face was symmetric. The lips were competent at rest and the naso-labial angle was average. No temporomandibular joint symptoms or signs were noted.

Intra-oral Features. Oral hygiene was good and except for both upper canine teeth, the permanent dentition was erupted up to the second molar teeth. There were large, but sound restorations in the lower first molar teeth. The maxillary arch was severely crowded with both canine teeth impacted in the line of the arch. Typically for Class III malocclusions, the lower arch was fairly well aligned with only 1–2 mm crowding mostly at the incisors.

Inter-arch Relationships. The incisor relationship was Class III with a reverse overjet of −2 mm and a complete overbite of 4 mm. The upper centreline was coincident with face, but the lower was 3 mm to left. The molar relationships were Class I on the left and 1/4 Class III on the right. There was a small anterior and left displacement of the mandible on closure with the first contact on the incisor teeth.

Radiographic Report

A dental panoramic tomogram confirmed the presence of unerupted third molar teeth and upper canine teeth. The canine teeth appeared favourable for alignment. The cephalogram was traced and the analysis (see Table 1) was interpreted as follows.

Pretreatment Cephalometric Interpretation. Maxillary retrognathia is suggested by the SNA angle of 77 degrees. The inter-arch anteroposterior relationship was mildly Class III according to the ANB angle and the Wits analysis. The anterior facial height ratio appeared to be normal and this was confirmed by the intermaxillary plane angle. The upper and lower incisor inclinations are close to normal values suggesting that no dental compensation has taken place.

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FIG. 1 Case 1: start of treatment.

TABLE 1 *Cephalometric analysis for case 1*

Variable	Normal	Pretreatment	Post-treatment	Treatment change
Sella–nasion–A point angle	82 ± 3	77·0	79·0	−1·0
Sella–nasion–B point angle	79 ± 3	76·0	80·0	−0·5
A point–nasion–B point angle	3 ± 1	1·0	−1·0	−2·0
WITS appraisal	0 mm	−6·0	−6·0	−0
Upper incisor to maxillary plane angle	108 ± 5	110·0	122·0	+11·0
Lower incisor to mandibular plane angle	92 ± 5	90·0	79·0	−11·0
Inter-incisal angle	133 ± 10	131·0	135·0	−4·0
Intermaxillary plane angle	27 ± 5	28·5	28·5	0
LAFH/TAFH* (%)	55%	56·0	57·5	+1·5
Lower incisor to A point–pogonion line	0–2 mm	6·0	2·0	−4·0
Lower lip to Ricketts E plane	−2 mm	−4	−3	+1

Source of normal values: Wits: Jacobson (1975); others: Houston *et al*. (1992)
*LAFH/TAFH = lower anterior face height to total face height ratio.

FIG. 2 Case 1: end of treatment.

Aims and Objectives of Treatment

1. Correct mandibular displacement.
2. Relieve crowding, expose and align maxillary canines.
3. Create a positive overjet and maintain a positive overbite.
4. Correct the centreline.
5. Create a functional buccal occlusion.

Treatment Progress

The patient was warned at the outset of the possibility of unfavourable growth making camouflage impossible. A removable appliance was first used to expand the upper arch width and procline the incisors. After 6 months no further expansion was feasible, but there was barely sufficient space for the alignment of the canines and the overjet was only just edge to edge. A sectional upper fixed appliance was placed to maintain the dental expansion. The upper canine teeth were surgically exposed and the first molar teeth were extracted to facilitate retraction of the lower labial segment and alignment of the upper canines. The extraction choice was dictated by the large fillings in the first molar teeth, but was certainly not the best choice for subsequent camouflage of the malocclusion. 0·022 × 0·028 Roth prescription pre-adjusted fixed appliances were placed to execute the alignment, space closure and interarch corrections. Alignment and space closure were completed using a routine arch wire progression up to 0·018 × 0·025 stainless steel which controlled the tendency of the molars to roll lingually during space closure. Once the majority of space closure was complete the incisor camouflage was maximized by:

FIG. 3 Case 1: cephalometric tracings superimposed along sella–nasion line, centred at sella.

FIG. 4 Case 1: cephalometric superimposition of maxilla and mandible on stable structures.

(1) continued use of Class III elastics right up to finishing;
(2) sacrifice of the incisor torque prescription by finishing in round wire;
(3) sacrifice of the lower canine tip prescription (by placing Tip Edge® brackets on lower canines, which allow up to 15 degrees of distal tipping).

Removable retainers were fitted and prescribed full time for 3 months followed by a further 18 months night only. Total active treatment time was 28 months, and the final occlusion is shown in Figure 3.

Interpretation of Cephalometric Changes (Table 1 and Figures 4 and 5). There appeared to be forward movement of both A point and B point according to SNA and SNB. The ANB angle became 2 degrees more negative suggesting unfavourable growth. In contrast the Wits analysis remained the same at −6. However, the Wits analysis is likely to under-estimate the skeletal deterioration in this case because of the prolonged use of Class III elastics which tended to cant the occlusal plane anti-clockwise. The vertical skeletal relationships remained virtually unchanged and are in the normal range.

Not surprisingly, the incisor inclinations showed upper incisor proclination and lower incisor retroclination.

Occlusal Indices

Index of Orthodontic Treatment Need:

Dental Health Component:	Start:	5i	Finish:	2g
Aesthetic component:	Start:	10	Finish:	1
Peer Assessment Rating (PAR):	Start:	59	Finish:	7
	Change:	56	% Change:	88·0

ICON (Daniels and Richmond, 2000)

Start	117	(In need of treatment)	Complexity grade	Very difficult
Finish	18	(Acceptable)	Improvement (Start—4× finish	45 (Greatly improved)

Analysis of the Treatment

The initial malocclusion although severe in appearance had a number of features which suggested a camouflage would be possible:

1. An edge to edge incisor relationship could be obtained.
2. The overbite was positive (important for stability).
3. The initial incisor inclinations were minimally compensated, suggesting scope for dental camouflage.
4. The underlying antero-posterior skeletal discrepancy was mild.

Lower arch extractions are not usually wise in a Class III patient who may still be a candidate for orthognathic surgery. A cephalogram taken at the end of the removable appliance therapy was compared to one taken at the initial

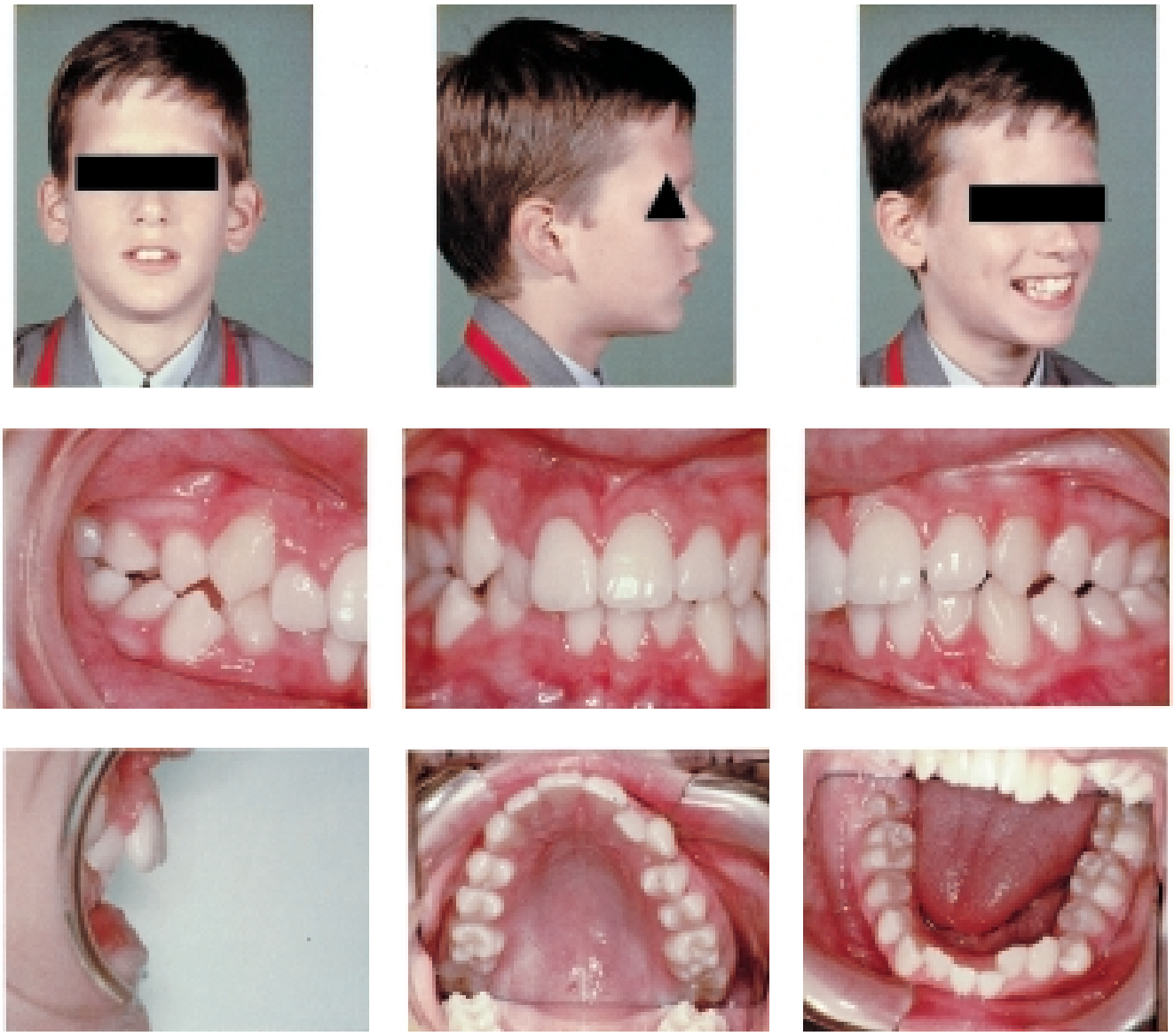

FIG. 5 Case 2: start of treatment.

presentation, which suggested little mandibular growth had taken place and the case was still amenable to camouflage.

Undoubtedly, a small increment of mandibular growth has made a perfect correction of the dental relationship unlikely. The patient was at the limit of camouflage.

Case II

Initial Presentation

The male patient presented at the age of 10 years and 6 months complaining 'I don't like my teeth because they stick out!' (see Figure 5). The medical history was clear.

Clinical Examination

Extra-oral Features. He had a moderate Class II profile with mandibular deficiency and maxillary excess. The Frankfort–mandibular plane angle and the lower facial height proportion were both average. No facial asymmetry was noted and the lips were incompetent at rest, with the lower lip trapped behind the upper incisors. There was 6 mm of upper incisor showing at rest with an average naso labial angle and average lip protrusion. No symptoms or signs of temporomandibular joint dysfunction.

Intra-oral Features. The oral hygiene was initially poor though the dentition was free of restorations and caries. All teeth up to the second permanent molars were erupted. An adaptive tongue to lower lip posture was present on swallowing. The periodontal tissues were healthy.

Intra-arch Features. The maxillary arch was irregular and crowded with 13 quite distally angulated. There was asymmetric upper incisor proclination resulting from a previous digit sucking habit. In the lower arch the teeth were also irregular and crowded, with 43 distally angulated.

Inter-arch Relationships. The incisor relationship was Class II division 1 with an overjet of 10 mm and overbite 6 mm, but incomplete. The centrelines were coincident, but both 3 mm to the right of the facial midline. The molar relationships were a full unit Class II on the left and Class I on the right. There was a crossbite on the right first premolars, but no associated displacement.

Radiographic Report

The third molar teeth were unerupted and no other abnormal findings were made. Cephalometric data is given in Table 2.

Pretreatment Cephalometric Interpretation. SNA was close to the ideal which was in contrast to the clinical assessment of a mild maxillary prognathism. The ANB angle and Wits analysis pointed toward a mild Class II skeletal anteroposterior relationship. The upper incisors were moderately proclined as could be expected following a digit sucking habit. The lower incisors were slightly proclined. The inter-maxillary plane angle and anterior facial height ratio were average, which confirmed normal vertical dimensions and facial divergence. The lower lip profile was close to the normal value but the cephalometric assessment must be regarded with caution because of the uncertain effects of facial posing and the lower lip trapping.

Aims and Objectives of Treatment

1. Correct the anteroposterior discrepancy.
2. Relieve crowding and align.
3. Reduce and overcorrect the overjet and overbite.
4. Obtain a functional buccal occlusion.
5. Obtain lip competency.

Treatment Progress

Oral hygiene reinforcement was undertaken over a number of preliminary appointments. Clark Twin Block (functional appliance) was worn full time for approximately 6 months until anteroposterior correction of molar and incisor relationships was obtained. The appliance was then worn at night time only prior to placement of fixed appliances (2 months). First premolars were extracted. Upper and lower fixed appliances (Roth prescription) utilizing continuous arch wire mechanics on 0·022 × 0·028 slot dimensions were then placed to complete the alignment levelling and space closure. Upper and lower removable retention appliances with Adams clasps on first molar teeth and looped long labial bows soldered to the clasp bridges were placed on debond and prescribed full time for the first 3 months (except for eating and during the evening). The retainers were then worn nights only.

Total active treatment time 2 years 1 month and the final occlusion is shown in Figure 6.

Assessment of Cephalometric Changes (see Figures 7 and 8). There was normalization of the skeletal pattern with forward movement of B point, which was reflected in the reduction in ANB and Wits values. The incisor and inter-incisor angulations became close to the ideal values. The upper and lower incisors were retracted, which in the upper arch contributed to the correction of the overjet and in the lower arch corrected the initial dento-alveolar compensation. The vertical relationships were little changed, which was reflected as minimal changes of the inter-maxillary plane angle and anterior facial height ratio.

Occlusal Indices

Index of Orthodontic Treatment Need:

Dental Health Component:	Start:	5a	Finish:	2g
Aesthetic component:	Start:	7	Finish:	1
Peer Assessment Rating	Start:	44	Finish:	2
	Change:	−42	% Change	95

ICON (Daniels and Richmond, 2000)

Start	72	(In need of treatment)	Complexity grade—Difficult	
Finish	13	(Acceptable)	Improvement (Start—4× finish)	20 Greatly improved

Analysis of Treatment

The antero-posterior skeletal discrepancy probably cannot be significantly influenced by the orthodontic mechanics in

TABLE 2 *Cephalometric analysis for case 2*

Variable	Normal	Pretreatment	Post-treatment	Treatment change
Sella–nasion–A point angle	82 ± 3	81·4	81·0	−0·5
Sella–nasion–B point angle	79 ± 3	76·5	78·0	+1·5
A point–nasion–B angle	3 ± 1	4·9	3·0	−2·0
WITS appraisal	0 mm	5·2	−0·5	−5·5
Upper incisor to maxillary plane angle	108 ± 5	114·5	106·0	−8·5
Lower incisor to mandibular plane angle	92 ± 5	96·0	92·5	−3·5
Inter-incisal angle	133 ± 10	123·5	135·5	+12·0
Intermaxillary plane angle	27 ± 5	26·0	26·0	0
LAFH/TAFH* (%)	55%	56·5	55·0	−1·5
Lower incisor to A point–pogonion line	0–2 mm	−1·5	−1·0	+0·5
Lower lip to Ricketts E plane	−2 mm	−3	−5·0	−2·0

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

FIG. 6 Case 2: end of treatment.

the long term, but the normal growth pattern (where the mandible grows more than the maxilla) will tend to reduce this antero-posterior discrepancy. Anchorage can be usefully gained in the short term by jumping the molar relationship with a combination of dental tipping and short-term mandibular repositioning. This is conveniently achieved using a functional appliance. The success rate of the Twin Block appliance is thought to be due to relatively favourable patient compliance and the possibility for fulltime wear.

The lower labial segment crowding is likely to be exacerbated by incisor proclination with the use of a functional appliance. Premolar extraction provided for the relief of crowding and provision of anchorage to allow over correction of the dental antero-posterior discrepancy. The prognosis for stability was reasonably good. The initial skeletal discrepancy was relatively mild with the upper dento-alveolar proclination mostly responsible for the increased overjet. The cessation of the sucking habit removes one of the main aetiological factors and successful overjet reduction should correct the lip trap, which maintained the presenting incisor relationship. The establishment of lip competence will help to maintain the corrected positions.

Case III

Initial Presentation

This 13-year-old male patient presented in the permanent dentition, complaining of 'crooked teeth which stick out'. No relevant medical history.

Clinical Examination (see Figure 9)

Extra-oral Features. There was a mild Class II skeletal pattern with mandibular deficiency. The Frankfort–

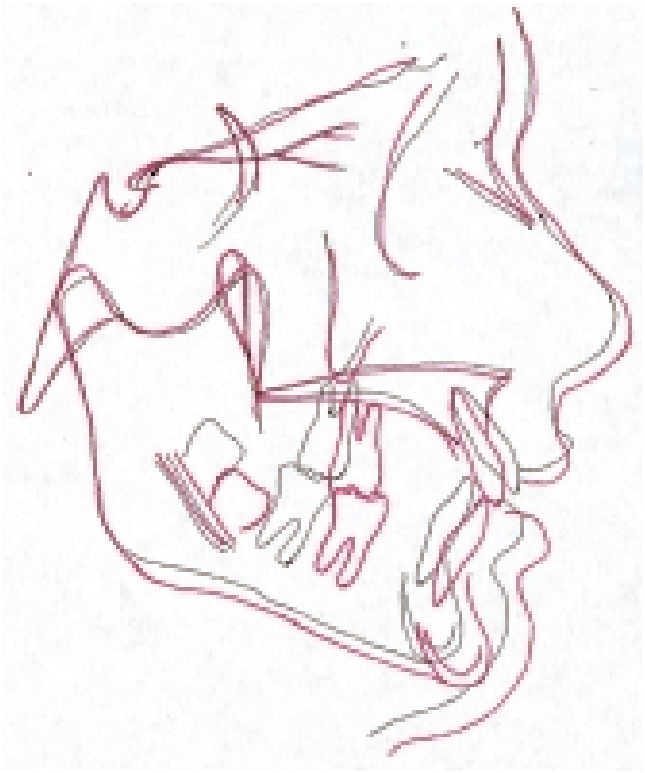

FIG. 7 Case 2: cephalometric tracings superimposed along sella–nasion centred at sella.

FIG. 8 Case 2: cephalometric superimposition of maxilla and mandible on stable structures.

mandibular plane angle was mildly increased, but the lower face height was normal. There was no facial asymmetry and the lips were incompetent at rest. Lip closure was possible with effort. There was 4 mm incisor exposure at rest and obvious gingival exposure on smiling. The upper incisors were above lower lip control and the nasolabial angle was moderately obtuse. The lips appeared to be short in length. No temporomandibular joint symptoms or signs were noted.

Intra-oral Features. The oral hygiene was fair and all the permanent teeth were erupted up to the second permanent molars. The third molars were unerupted, but present.

Intra-arch Features. The maxillary arch was mildly crowded. The anterior alignment was mildly irregular with asymmetric protrusion of the incisors. Buccal segments were aligned. Mandibular arch was moderately crowded. The labial segment was mildly proclined and the buccal segments were aligned.

Inter-arch Relationships. The incisor relationship was Class II division 1 with overjet of 9 mm and a complete overbite of 1–4 mm. The centrelines were coincident to the facial midline. The molar relationships was ¼ Class II on the left and Class I on the right. There was a crossbite on 12 and 43, which did not cause any mandibular displacement.

Radiological Report

Dental Panoramic Tomogram and Lateral Cephalogram revealed no gross pathology. Periodontal bone levels were normal and the teeth caries free. All teeth were present with the third molars unerupted.

Pretreatment Cephalometric Interpretation

The cephalometric data is given in Table 3. The values for SNA and SNB suggested a mild bimaxillary retrognathia, which was contradictory to the clinical examination. The ANB angle suggested a mild Class II inter-arch relationship which was confirmed by the Wits analysis. The inter-maxillary plane angle was mildly increased in agreement with the clinical assessment of mild inter-maxillary divergence (using the Frankfort–mandibular plane angle), but the anterior facial height ratio was normal. The clinical assessment of bimaxillary dento-alveolar protrusion was confirmed by the upper incisor to maxillary, and lower incisor to mandibular plane angles and the inter-incisor angle. Mandibular incisor protrusion was confirmed by the tip to APo line relationship. The lower lip pattern appeared to be protrusive relative to the Ricketts standard.

Aims and Objectives of Treatment

(1) Relief of crowding.
(2) Reduction of dento-alveolar protrusion.
(3) Correction of inter-arch relationships to Class I.

Treatment Progress

The first premolars were extracted and Tip Edge® appliances placed. A typical three stage treatment progression

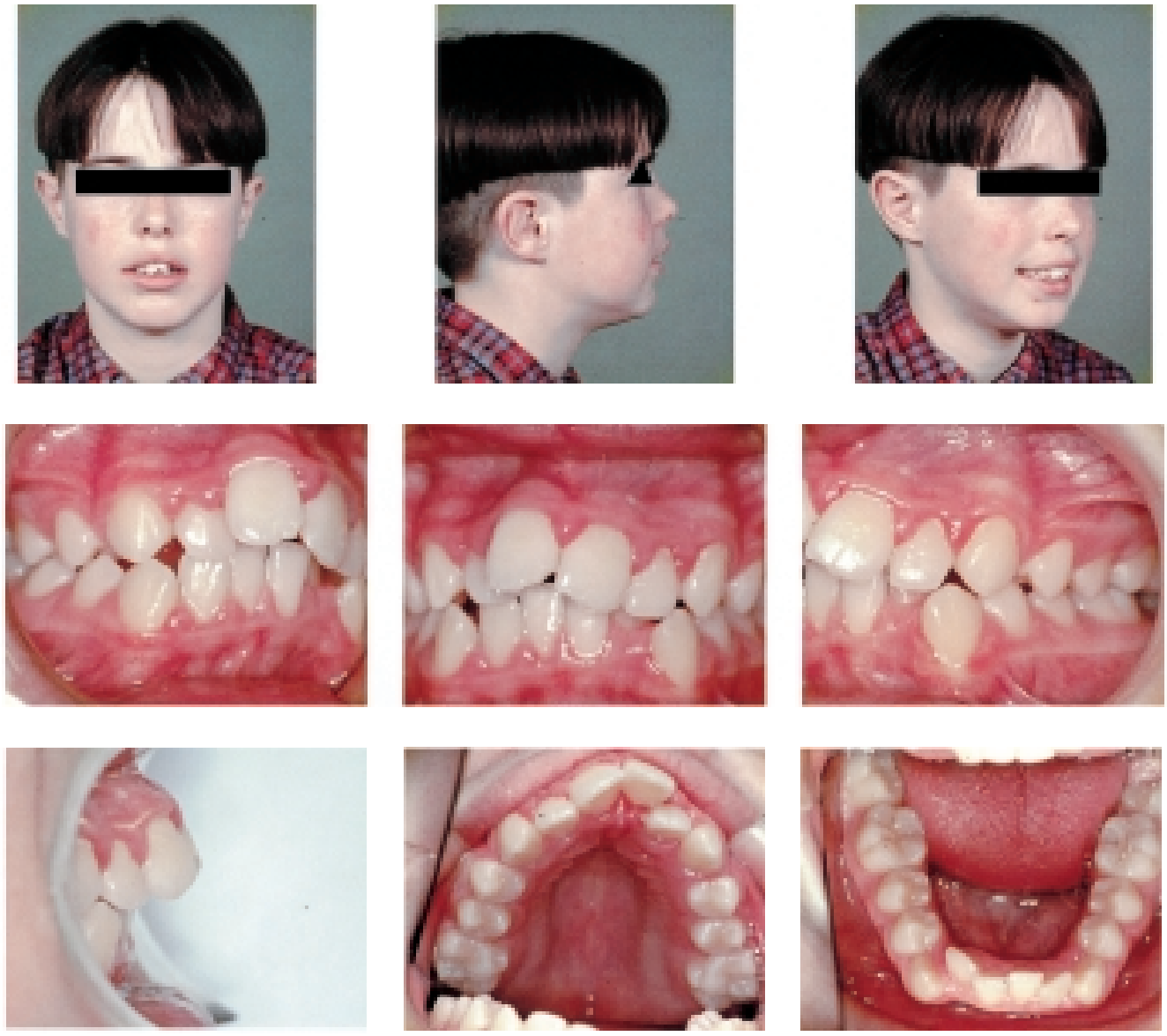

FIG. 9 Case 3: before treatment.

TABLE 3 *Cephalometric analysis for case 3*

Variable	Normal	Pretreatment	Post-treatment	Treatment change
Sella–nasion—A point angle	82 ± 3	78·5	78·0	−0·5
Sella–nasion–B point angle	79 ± 3	72·5	73·0	+0·5
A point–nasion–B point angle	3 ± 1	6·0	5·0	−1·0
WITS appraisal	0 mm	4·5	0	+4·5
Upper incisor to maxillary plane angle	108 ± 5	121·0	104	−17·0
Lower incisor to mandibular plane angle	92 ± 5	95·5	94·0	−1·5
Inter-incisal angle	133 ± 10	112·5	131·0	+18·5
Intermaxillary plane angle	27 ± 5	31·0	29·0	−2·0
LAFH/TAFH* (%)	55%	54·5	55·0	+0·5
Lower incisor to A point–pogonion line	0–2 mm	3·0 mm	+2·5	−0·5
Lower lip to Ricketts E plane	−2 mm	+5 mm	0	−5·0

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

FIG. 10 Case 3: end of treatment.

was followed. The initial alignment was carried out using 0·012 Nickel titanium piggy back wires on an 0·016 high tensile Australian base wire. This allowed simultaneous overjet and overbite reduction during the alignment phase. The second premolars were bracketed once the overjet was reduced prior to placement of an 0·020 Australian wire for space closure. Finally, an 0·0215 × 0·028 rectangular stainless steel wire and sidewinder springs were placed for correction of tooth inclination and angulation. As a finishing procedure the arch wires were sectioned distal to the canines to allow buccal segments to settle prior to debond. Very light Class II elastics were used through the majority of the treatment. During the finishing stages various combinations of asymmetric elastics and posterior box elastics were employed to correct centreline discrepancies and encourage buccal segment settling. Stage 1 took 5 months, stage II took 5 months and stage III took 11 months. The final occlusion is shown in Figure 10.

Analysis of Cephalometric Changes (see Figures 11 and 12). There was little change in the antero-posterior position of the dental bases relative to the cranial base as measured by SNA and SNB, but the skeletal pattern altered towards Class I with a post-treatment ANB angle of 5 degrees and a Wits value of 0 mm. The Wits value is probably less valid as an assessment of skeletal change in this treatment because the prolonged use of Class II elastics will tend to cant the occlusal plane in a clockwise

FIG. 11 Case 3: cephalometric tracings superimposed along sella–nasion centred at sella.

manner which reduces the apparent Class II discrepancy. The use of Class II elastics may also change the vertical dimensions and while the inter-maxillary plane angle appeared little changed there was a measurable increase in the lower face height proportion. Incisor inclinations normalised during treatment. The lower incisor became less prominent relative tot he APo line and the lower lip became less protrusive according to the Ricketts standard.

Occlusal Indices

Index of Orthodontic Treatment Need

Dental Health Component	Start:	4a	Finish:	2g
Aesthetic component:	Start:	7	Finish: 2	
Peer Assessment Rating	Start:	43	Finish:	1
	Change:	−42	% Change:	97·6

ICON (Daniels and Richmond, 2000)

Start	76	(In need of treatment)	Complexity difficult	
Finish	15	(Acceptable)	Improvement (Start—4× finish)	16 Greatly improved

Analysis of Treatment

This growing male patient presented with a significantly increased overjet on a mild skeletal Class II base with

FIG. 12 Case 3: cephalometric superimposition of maxilla and mandible on stable structures.

bimaxillary dento-alveolar protrusion and arch crowding. The upper incisors were above the lower lip control and the lip pattern was incompetent. No adaptive tongue to lip swallowing function was noted, and the aetiology of the increased overjet was attributed mostly to dento-alveolar protrusion and lack of lip control. The degree of crowding and dento-alveolar protrusion suggested an extraction treatment was the most appropriate approach for obtaining the treatment aims. There was a Class I molar relationship which suggested little space would be required for skeletal camouflage. Retracting the incisors would improve the prospects for lip competency, in addition to the long-term pattern of increase in lip length.

The tip edge appliance was used because it is thought to be more conservative of anchorage and would allow free distal tipping of the incisors and canine teeth.

Acknowledgements

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References

Daniels, C. P. and Richmond, S. (2000)
The development of the Index of Complexity Outcome and Need (ICON),
Journal of Orthodontics, **27**, 149–162.

Houston, W. J. B., Stephens, C. D. and Tolley, W. H. A. (1992)
A Textbook of Orthodontics,
Wright, Oxford.

Jacobsen (1975)
American Journal of Orthodontics, **67**, 125–133.