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Clinical Section

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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 at the examination with the highest overall mark in Part II of the examination. The prize is only awarded if the examiners believe the candidate's performance is of a sufficiently high standard.

As part of the examination, which includes a long clinical case, diagnostic tests, oral examinations and a written paper, the candidate must present three personally-treated, fully documented cases on which the candidate is examined orally. Details of two of the treated cases are presented in this paper.

Case Report 1

A 12-year 2-month-old Caucasian female was referred by her General Dental Practitioner complaining of her overlapping front teeth.

On examination, she presented with a Class II division 2 incisor relationship on a mild skeletal II base with bimaxillary retrognathia. The FMPA and lower anterior face height was increased. Clinically, her lips were apart at rest, with upper and lower lip well behind Ricketts' aesthetic 'E' line. The nasolabial angle was obtuse.

Intra-oral examination revealed that she was in the permanent dentition stage with good oral hygiene and dental condition. Her lower arch had mild crowding anteriorly with retroclined incisors and upright canines. The buccal segments were generally well aligned with mild mesiolingual rotations of the first and second premolars. The upper labial segment was moderately crowded with retroclined incisors. The upper left canine was mesially angulated and the upper right, distally angulated. Both upper buccal segments were well aligned. The upper lateral incisors were measured to be slightly diminutive relative to their counterparts and a Bolton tooth size discrepancy revealed the maxillary labial segment to be deficient by 3 mm.

In occlusion, the incisor relationship was Class II division 2, with an overjet of 4 mm and an increased overbite, complete to the palate. The first permanent molars in the left buccal segment were in crossbite. The molar relationship was full unit Class II on the right and three-quarter unit Class II on the left. Both upper and lower centre lines were coincident with the facial midline (Figure 1a–h).

Assessment of the functional occlusion revealed a lateral mandibular displacement following initial contact between the upper left first premolar and lower left canine. There was group functional guidance on both right and left sides. No adverse signs or symptoms related to the temporomandibular joint, and associated structures were found on examination.

The panoramic radiograph revealed congenital absence of both lower third molars. The upper third molars were developing in a normal position. The upper anterior occlusal radiograph confirmed the upper incisors to have normal root morphology. The lateral cephalogram confirmed a mild skeletal II pattern. Using an Eastman conversion, the ANB difference was 5 degrees and the Wits analysis difference was 4 mm. The upper incisors were retroclined at 100 degrees to the maxillary plane and the lower incisor were inclined at 84 degrees to the mandibular plane. The inter-incisor angle was increased at 144 degrees and the lower incisor tip was just behind the centroid of the upper incisor. Cephalometric analysis is presented in Table 1.

The aetiology of this malocclusion could be attributed to a combination of factors. The Class II skeletal pattern has contributed to the post-normal buccal segment relationship. At rest, the lower lip covered the majority of the upper incisors and this has contributed to their retroclination. The mild degree of lower incisor imbrication may have been secondary to possible trapping of the lower labial segment by the palatal mucosa associated with the deep overbite.

For this patient, the Dental Health Component (DHC) score on the Index of Treatment Need (IOTN) was 4d as there was a contact point displacement of greater than 4 mm.

TABLE 1 *Case report 1: pre- and post-treatment cephalometric analysis*

	Pretreatment	Post-treatment
SNA (degrees)	76	75
SNB (degrees)	73·5	74
ANB (degrees)	2·5 (corrected 5)	1 (corrected 4)
SNMxP (degrees)	8	7
MxMdP (degrees)	35	35
Wits analysis (mm)	4	3
UI/MxP (degrees)	100	106
LI/MdP (degrees)	84	87
UI/LI (degrees)	144	131
LI–APo (mm)	−2	0
LAFH/TAFH (%)	58	60

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FIG. 1 (a–h) Case report 1: pretreatment photographs.

The pretreatment weighted Peer Assessment Rating (PAR) score was 32.

The aims of treatment were:

(1) to maintain the patient's existing facial profile;
(2) levelling and alignment of both upper and lower arches;
(3) correction of the saggital relationship and establishment of a Class I molar relationship;
(4) correction of the unilateral crossbite and elimination of the mandibular displacement on closure;
(5) correction of incisor relationship to Class I with reduction of the overjet and overbite;
(6) establishment of a good functional occlusion.

The treatment plan was as follows:

(1) oral hygiene reinforcement and dietary advice;
(2) upper removable appliance phase for midline expansion and commencing distal movement of the upper buccal segments with extra-oral traction;
(3) upper and lower pre-adjusted Edgewise appliances for levelling, aligning and detailing the occlusion;
(4) retention.

Treatment was planned without extractions as space analysis calculated 8 mm of space requirement in the upper arch. This was gained using extra-oral traction to distalise the buccal segments. Active treatment required 22 visits over a 26-month period. The upper removable appliance was worn for the first 8 months and combination pull safety headgear was fitted once the unilateral crossbite had been corrected. Headgear wear was maintained throughout the remaining treatment period. Once the buccal segment relationship had been corrected, bands were cemented to

the upper first molars and the headgear was adjusted to apply an intrusive high pull force. Pre-adjusted Edgewise brackets (0·022 × 0·028-inch slot, Andrew's prescription) were bonded to the upper teeth and levelling and alignment was achieved using superelastic nickel titanium wires. The lower fixed appliance was commenced when a round 0·018-inch stainless steel arch wire was ligated in the upper arch. The patient's original archform was maintained, whilst some expansion was allowed in the upper molar region to maintain correction of the unilateral cross bite. The arch wire sequence was progressed until 0·019 × 0·025-inch stainless steel wires were ligated in both arches. After allowing the flat arch wires to be expressed, overbite reduction was achieved by bending an increased curve of Spee in the upper archwire. The second permanent molars had been included in the appliance by this stage.

A mid-treatment lateral cephalogram was taken. This showed that lower incisor inclination had increased by 3 degrees to the mandibular plane. Light interdental stripping of the lower labial segment was undertaken and the 0·019 × 0·025-inch stainless steel wire was religated with lingual crown torque. Additional palatal root torque was applied to the upper incisors. Intra-traction was necessary in the upper buccal segments to close space and provide anchorage for the palatal root torque applied to the upper labial segment. A 1-mm centre line discrepancy was corrected using unilateral light Class II traction on the right side only together with an asymmetric anterior elastic.

Following debond, a palatal fixed retainer in 0·0175-inch twistflex stainless steel was bonded to the upper incisors and a similar lingual fixed retainer was bonded to the lower incisors and canines. In addition, an upper Hawley style retainer was fitted to maintain arch width. (Figure 2a–h)

FIG. 2 (a–h) Case report 1: post-treatment photographs.

Case 1 Assessment

This patient presented with a Class II division 2 malocclusion on a mild skeletal II base with several unusual features. The MM angle and LAFH were increased, and this was associated with a deep and complete overbite. Treatment was undertaken without extractions taking care not to change the existing facial profile, as the patient presented with bimaxillary retrognathia, with a resulting retrusive facial profile where both upper and lower lips were well behind Ricketts' aesthetic line. Although the patient co-operated well with treatment, continual motivation was required to achieve the hours of necessary headgear wear. The subject has an identical twin sister who also presented with a Class II division 2 malocclusion, but less severe in nature and which was successfully treated in a much shorter time.

Cephalometric superimposition revealed that a vertical pattern of growth continued despite high pull headgear worn. There was little change in the anteroposterior plane. Effective reduction of the overbite has been achieved. The interincisal angle has reduced to 131 degrees and the lower incisor tip now lies ahead of the centroid of the upper incisor, a position believed to be favourable in the long term stability of corrected Class II division 2 incisor relationships (Houston, 1989; Figure 3). Although the upper incisor inclination has been corrected, the patient continues to have a high lower lip resting line and this may influence the incisor inclination in the future. The lower labial segment has been slightly advanced, but the pretreatment malocclusion suggested that the incisors may have been trapped by the palatal mucosa and the deep overbite. Posttreatment, the lower incisors now lie on the APo line. The lower intercanine width has been maintained at 27 mm. On completion of treatment, the patient exhibited good functional occlusion with canine guidance on right and left lateral excursions, and anterior guidance on protrusion. There was an absence of non-working side interferences.

The post-treatment PAR score of 2 demonstrates a 94 per cent reduction in weighted PAR score. This lies in the 'greatly improved' category of the PAR nomogram.

FIG. 3 Case report 1: pretreatment (black) and post-treatment (red) cephalometric tracings superimposed on SN at Sella.

Case Report 2

A 14-year-old Caucasian female was referred by her General Dental Practitioner complaining of the appearance of the gaps between her front teeth. She presented with a Class I malocclusion on a skeletal I base with bimaxillary proclination. Both upper canines were ectopically positioned. The FMPA and lower anterior face height were within the normal range. Her lips were apart at rest with the upper incisors controlled by the lower lip. She had a full convex facial profile with an average nasolabial angle.

With the exception of the upper canines and third molars, all the permanent teeth had erupted. The patient had excellent oral hygiene and dental condition. The lower labial segment was proclined relative to the mandibular base and exhibited mild crowding. Both lower canines were mesially angulated. The upper labial segment was spaced with proclined incisors. Both upper and lower buccal segments were reasonably well aligned.

In occlusion, the incisor and buccal relationships were both Class I. There was good buccal segment interdigitation of the teeth. The overjet was measured to 3 mm and the overbite was average and complete to the palatal surfaces of the upper incisors. Both dental centre lines were coincident with the facial midline. Occlusal examination revealed group functional guidance on both sides with non-working side interferences between both right and left second permanent molars. No symptoms of mandibular dysfunction were reported, nor could any clinical signs be determined (Figure 4a–h).

The upper anterior occlusal radiograph, together with the dental pantomogram confirmed that both upper canines were significantly displaced palatally. There was no evidence of root resorption affecting the upper incisor teeth. The dental pantomogram confirmed the presence of all four third molars which were seen to be developing in a normal position. The lateral cephalogram confirmed that the patient had a skeletal I pattern with bimaxillary proclination of the incisors. The maxillary-mandibular planes angle and lower anterior face height were within the normal range. The lower incisors were advanced in relation to APo. Cephalometric analysis is presented in Table 2.

It has previously been reported that ectopic eruption of upper canines is often associated with microform upper lateral incisors (Becker *et al*., 1981). In this case, the upper lateral incisors appeared to be smaller relative to the remaining dentition and a Bolton tooth size analysis revealed that the maxillary labial segment was deficient by 2·5 mm. This can be cited as a aetiological factor. The bimaxillary proclination of the teeth was due to the soft tissue morphology.

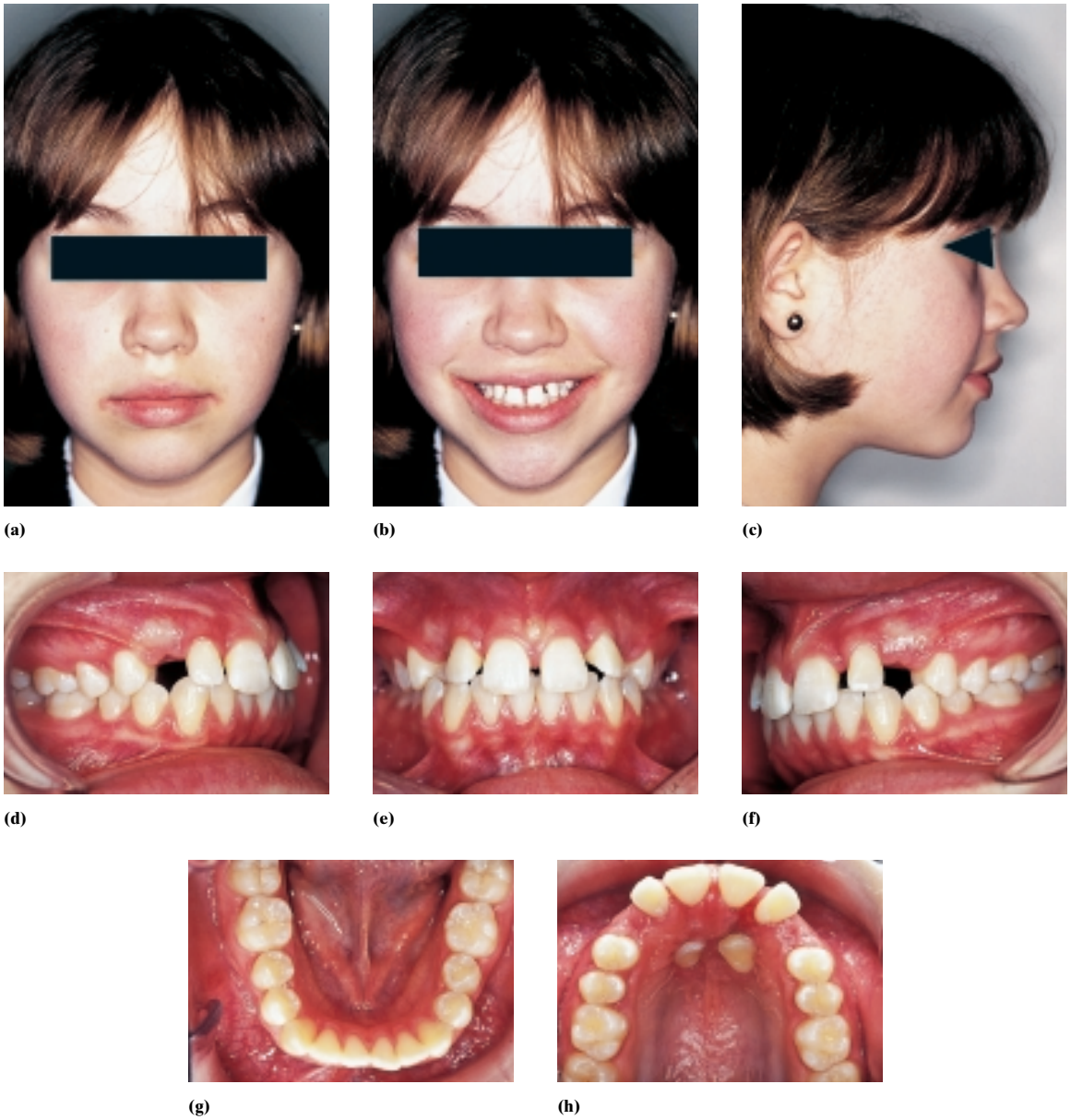

FIG. 4 (a–h) Case report 2: pretreatment photographs.

TABLE 2 *Case report 2: pre- and post-treatment cephalometric analysis*

	Pretreatment	Post-treatment
SNA (degrees	83	83
SNB (degrees)	79	80
ANB (degrees)	4	3
SNMxP (degrees)	5	4
MxMdP (degrees)	28	28
Wits analysis (mm)	2	1
UI/MxP (degrees)	112	114
LI/MdP (degrees)	104	103
LI to APo (mm)	+5	+7
LAFH/TAFH (%)	56	58

The need for orthodontic treatment as expressed by the Index of Treatment Need was grade 5i due to the impacted teeth. The pretreatment weighted PAR score was 23.

The aims of treatment were:

(1) to maintain the patient's existing facial profile;
(2) to bring the maxillary canines into their correct position within the maxillary arch;
(3) accept the bimaxillary proclination and maintain incisor and molar relationships;
(4) establishment of a good functional occlusion with elimination of the non-working side interferences.

The treatment plan was as follows:

(1) oral hygiene reinforcement and dietary advice;
(2) referral to the Oral and Maxillofacial Surgeon for surgical exposure of both upper canines under general anaesthesia;
(3) modified transpalatal arch with soldered springs to encourage the upper canines towards the line of the arch;
(4) upper and lower pre-adjusted Edgewise appliances.

Analysis of space requirements demonstrated that there was sufficient space in the maxillary arch to accommodate both upper canines. In the lower arch, the mild degree of crowding was relieved by tooth reduction of 1 mm in total.

Following surgical exposure of both upper canines, the palatal surfaces were visible close to the maxillary midline. Active treatment required 26 visits over a 30-month period. A transpalatal arch was used in the first instance to maintain the intermolar width. This was modified in design, with two springs soldered to it which inserted into eyelet attachments bonded on to the palatal surfaces of the maxillary canines. With activation, the springs gradually encouraged the canines to move towards the line of the arch (Figure 5). Pre-adjusted Edgewise brackets (0·022 × 0·028-inch slot, Andrew's prescription) were bonded to the upper teeth. Following levelling and alignment using super-elastic nickel titanium wire, elastomeric chain was used to consolidate the anterior segment spacing on a 0·020-inch stainless steel wire. At this stage, one of the palatal springs

FIG. 5 Design of modified transpalatal arch.

(a) (b) (c)

(d) (e) (f)

(g) (h)

FIG. 6 (a–h) Case report 2: post-treatment photographs.

fractured and it was decided to remove both whilst recementing the palatal arch to maintain intermolar width. The canines were progressively brought towards the arch wire using elastomeric thread, the pull being directed to derotate both canines so that brackets could be bonded to their buccal surfaces. As the teeth moved closer to the line of the arch, a 0·014-inch superelastic nickel titanium wire was passed through all the bracket slots and fully ligated to the canine brackets in a 'piggy-back' fashion. A 0·018-inch stainless steel wire was then ligated over the superelastic wire. This proved to be a very effective means of applying a light, continuous force to the canines and bring them towards their final position. At this stage, lower molar bands were selected and bonded together with brackets.

After 1 year of active treatment it was possible to reposition the upper canine brackets into their correct position. The arch wire sequence was progressed until a 0·017 × 0·025-inch rectangular nickel titanium wire was ligated to commence torque expression in the upper arch. Bands were placed on the second permanent molars, the palatal arch was removed and eventually 0·019 × 0·025-inch rectangular stainless steel wires were ligated into both arches. After allowing flat arch wires to be expressed, a mid-treatment lateral cephalogram was taken which showed that the lower incisor inclination had increased by 3 degrees to the mandibular plane. Light interdental reduction of the mandibular incisors was undertaken and the 0·019 × 0·025-inch stainless steel wire was religated with lingual crown torque. Both upper canines still required considerable buccal root torque and, hence, an upper 0·019 × 0·025 beta-titanium wire applying buccal root torque to both canines was ligated. This wire was religated for the next six months of treatment. Finally, an upper 0·019 × 0·025-inch stainless steel wire was used for the remaining 3 months of treatment (Figure 6a–h).

A lateral cephalogram was taken and this confirmed that all the pre-treatment objectives has been achieved. The lower incisors were now lying in their pretreatment labio-lingual position (Figure 7). Parallel periapicals radiographs of both upper canines exhibited good alveolar bone levels. There was pocketing less than 3 mm adjacent to these teeth.

Following debond, a palatal fixed retainer in 0·0175-inch twist flex stainless steel wire was bonded to the upper incisors and canines. A lower Hawley style retainer was also fitted.

Case 2 Assessment

Ericson and Kurol (1988) have suggested that if the crown of the canine has crossed the midline of the central incisor on a radiograph then the canine is in an unfavourable position with respect to bringing it into alignment. In this case, both canines were in unfavourble positions. Despite being informed of the risks, the patient opted to attempt alignment of both canines. The degree of lower arch crowding was very mild and therefore, as extractions were not considered to be necessary as part of the treatment plan, it was decided to proceed with exposure of the canines.

As the patient was happy with her facial appearance, reduction of the bimaxillary proclination was not considered. Indeed, any correction would have to be retained on a long-term basis as stability would be questionable due to the soft tissue aetiology.

FIG. 7 Case report 2: pretreatment (black) and post-treatment (red) cephalometric tracings superimposed on SN at Sella.

The duration of active treatment was two-and-a-half years. However, buccal root torque was applied to both upper canines for 9 months of this time. Although post-treatment periapical radiographs of these teeth showed good alveolar bone levels, an opinion was sought from a Periodontist. No treatment was suggested for the 3-mm pocketing and a further review was arranged after 3 months. Care had been taken to use very light forces throughout treatment and fortunately, the patient maintained an excellent standard of oral hygiene throughout treatment despite the difficulty encountered due to the palatal positions of the canines and auxilliary attachments. Gingival recontouring on the upper right canine was suggested to improve aesthetics, but was declined by the patient. The canines will require long-term retention in view of the magnitude of movement that was required. However, the prognosis is favourable as both canines had good buccal root torque at the end of treatment.

The post-treatment cephalogram showed that both upper and lower incisors had maintained their pretreatment labio-lingual inclination. The lower intercanine width has been maintained at 26 mm. Cephalometric superimposition revealed a mainly vertical pattern of growth.

On completion of treatment, clinical examination revealed that the non-working side interferences had been eliminated between the second permanent molars, and that the patient had group functional guidance on both right and left lateral excursions.

The post-treatment PAR score of 1 demonstrates a 96 per cent reduction in weighted PAR score which lies in the 'greatly improved' category of the PAR nomogram.

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