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CLINICAL SECTION

The B.O.S. Intercollegiate M.Orth. Prize of the Royal Colleges of England and Glasgow 2000

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The inaugural sitting of the Intercollegiate Membership in Orthodontics examination took place in the summer of 2000 in London. As a part of this new examination, the candidate with the highest overall mark in Part II of the examination is awarded the Intercollegiate MOrth medal.

This medal replaces the previous BSSO MOrth Medal, which was awarded by the Royal College of Surgeons of England, and is only awarded if the examiners feel the candidate's performance is of a sufficiently high standard.

Part II of the examination includes a long clinical case, diagnostic tests, oral examinations, and the presentation of five personally treated clinical cases. The examiners choose two of these five cases to question the candidate as to their clinical ability and understanding of mechanics. Details of two of the treated cases are presented in this paper.

Case report 1

A 15-year 4-month-old Caucasian male was referred by his general dental practitioner complaining of the crooked appearance of his upper teeth. He presented with a Class II malocclusion on a mild skeletal III base with an increased Frankfort-mandibular planes angle and increased lower face height. His lips were competent at rest and his nasolabial angle was obtuse.

Intra-oral examination revealed the presence of all permanent teeth excluding the third molars. There was a hypoplastic pit on the upper right first molar, but otherwise the oral hygiene was good and the remainder of the dentition healthy. The lower arch had mild crowding anteriorly with retroclined lower incisors and a disto-angular lower right canine. The lower left canine was upright and was mesiolingually displaced. The upper labial segment was severely crowded with the upper left lateral incisor being palatally excluded. Both upper canines were distally angulated and there was a 1 mm midline diastema with no fraenal involvement. The buccal segments in both arches were well aligned.

In occlusion the incisor relationship was Class II division 2, with a 2 mm overjet, and an increased and complete overbite. The upper centre line was 1.5 mm displaced to the left side, whilst the lower was coincident with the midline of the face. The molar relationship was three-quarters of a unit Class II on the left side and half a unit Class II on the right side. The first molars on both sides and the left lateral incisors were in crossbite, with no associated displacement (Figure 1a–h). The functional occlusion indicated non-working side contacts on the first molars bilaterally.

The panoramic radiograph showed normal development of all teeth including the third molars. The root morphology was normal on the upper standard occlusal. The lateral cephalogram indicated a skeletal I bordering on mild skeletal III pattern, with an ANB of 1 degree and a Wits analysis with BO being 1 mm anterior to AO. The increased maxillary-mandibular planes angle reinforced the clinical finding of an increased Frankfort-mandibular planes angle. The upper incisors were retroclined (95 degrees) as were the lower incisors (73 degrees), with a resultant inter-incisal angle of 160 degrees. Table 1 shows the cephalometric values before and after treatment.

The aetiology of this malocclusion is multifactorial. The inherited skeletal pattern is responsible for the transverse arch discrepancy and borderline skeletal III tendency. The muscular activity of the lower lip and the level at which it rests in relation to the upper incisors, contributed to the development of retroclined incisors and an increased overbite. A tooth size/arch length

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Fig. 1 (a–h) Case 1 at start.

Table 1 Cephalometric analysis

Parameter	Pretreatment	End of treatment	Change
SNA	81	77	–4
SNB	80	77	–3
ANB	1	0	–1
MMPA	32	32	0
Upper incisor to maxillary plane	95	104	+9
Lower incisor to mandibular plane	73	80	+7
Lower incisor to A-Po line	–4 mm	–3 mm	+1 mm
Inter-incisal angle	160	143	–17
Lower face height percentage	55	56	+1

discrepancy accounts for the degree of crowding in the upper arch and the lower left canine is lingually displaced due to the eruptive guidance of the palatally excluded upper left lateral incisor.

The classification of treatment need for this malocclusion was 4d, the weighted PAR score prior to treatment was 32.

The aims of treatment were to:

- Maintain the facial profile.
- Correct the crossbites.
- Alleviate the crowding and close the midline diastema.

Fig. 2 (a–h) Case 1 at debond.

- Reduce the overbite to less than one-third coverage of the lower incisors and simultaneously establish an optimal edge-centroid relationship.
- Correct the molar relationship to Class I.

The treatment plan is outlined below:

- Oral hygiene and dietary advice.
- Extraction of 4|4 and 5|5.
- Quadhelix to expand the upper arch.
- Upper and lower fixed appliances using the Tip-Edge appliance system.
- Upper and lower bonded retainers 321|123 and 321|1234.
- Upper and lower Hawley retainers.

The lower second premolars were extracted to allow resolution of the crowding and allow a degree of arch contraction, thus helping with correction of the bilateral first molar crossbites. The upper arch extractions allowed relief of crowding and subsequent incorporation of the upper left lateral into the arch.

The total treatment time was 24 months. Treatment commenced with 'pre-stage 1' expansion of the upper arch using a quadhelix activated by half a molar width on each side. Once adequate expansion had been achieved the respective premolar teeth were extracted and stage 1 Tip-edge commenced. Conventional Tip-edge mechanics were not adopted in stage 1 due to the absence of a significant overjet and the potential worsening of the

Frankfort-mandibular planes angle and lower face height, which may result from the use of inter-maxillary traction. Hence, all of the upper and lower teeth were bonded with 0.022 × 0.028-inch Tip-edge brackets, and flat 0.016-inch stainless steel (ss) archwires with circle loops mesial to both canines were inserted. Once a degree of levelling had been achieved, space was created for the upper left lateral incisor and the lower left canine by the use of open coil spring combined with E-links to aid retraction, on 0.020-inch ss archwires. Stage 2 involved the use of 'E-links' on 0.020-inch ss archwires to close the residual spacing. When this was complete, the quadhelix was removed and stage 3 Tip-edge was commenced using 0.0215 × 0.028-inch ss archwires and 'sidewinder springs'. A lateral cephalogram was taken 4 months into stage 3, which confirmed the improvement in inter-incisal angle subsequent to the torquing effect of the 'sidewinder springs'. Finishing required the use of a lower sectional braided 0.021 × 0.025-inch ss archwire and inter-maxillary seating elastics to allow closure of the mild lateral open bites. The patient was debonded after 24 months of treatment (Figure 2a–h). Upper and lower 0.0175-inch multi-strand stainless steel bonded retainers were placed in the upper and lower labial segments after debond; the lower one extending to the lower left first premolar due to the initial rotation of the lower left canine. Upper and lower Hawley retainers were also fitted to maintain the transverse correction and space closure.

Case assessment

Superimposition of the lateral cephalograms (Figure 3) indicated an almost vertical growth pattern; even without the use of inter-maxillary elastics. The incisor angulations improved due to the expression of palatal and lingual root torque on the respective incisors from the effect of the sidewinder springs on the archwires. This resulted in the inter-incisal angle decreasing by 17 to 143 degrees, and the edge-centroid relationship correcting such that the lower incisor tip was anterior to the root centroid of the upper incisor. The lower incisor angulation was still reasonably upright in the progress cephalogram. The lower inter-canine width has increased by 3 mm with treatment; this is likely to be stable in this case due to the initial lingual displacement of the lower left canine. The buccal root torque on the upper left lateral incisor could have been improved further; however, there is a definitive overbite associated with this tooth and so relapse of the crossbite is unlikely. At the end of treatment the patient exhibited bilateral group function for lateral excursion in dynamic occlusion; there were no non-working side interferences and anterior guidance with gentle posterior disclusion was evident on protrusion.

The post-treatment PAR score of 4 showed a reduction of 28 points and an improvement of 88 per cent, which corresponds to a 'greatly improved' nomogram score.

Case report 2

A 10-year-old Caucasian female was referred by her general dental practitioner and was unhappy that her upper front teeth were sticking out. She presented with a Class II division 1 malocclusion on a moderate skeletal II pattern with a slightly reduced lower face height and a normal Frankfort-mandibular planes angle, but a retrusive facial profile. Her lower lip was 'trapped' behind her upper incisors at rest and she had an increased labiomental fold associated with an active mentalis muscle.

Fig. 3 Case 1: lateral cephalograms at start and debond.

She presented in the mixed dentition, with all incisors and first molars present, as well as both lower canines partially erupted. Oral hygiene was poor at initial presentation but improved with instruction. The lower labial segment was moderately crowded and the lower left buccal segment was spaced due to early loss of the first deciduous molar. The upper labial segment was mildly spaced and proclined, and it was noted that the upper lateral incisors appeared disproportionately large. The upper buccal segments and the lower right buccal segment were well aligned.

In static occlusion the incisor classification was Class II division 1 and the molar relationship was a half unit post-normal bilaterally. The overjet was 12 mm to the left central incisor and 9 mm to the right incisor. The overbite was increased and complete to the palatal mucosa, with occasional trauma to the tissues, and both centre-lines were coincident with the midline of the face (Figure 4a–h). The lateral excursions were guided, on both sides, by the working side lower lateral incisors and the upper deciduous canines.

Panoramic radiography confirmed the presence of all permanent teeth including the third molars. The lateral cephalogram confirmed the moderate skeletal II pattern with an ANB angle of 7 degrees, with the upper incisors proclined at 126 degrees, and the lower incisors being

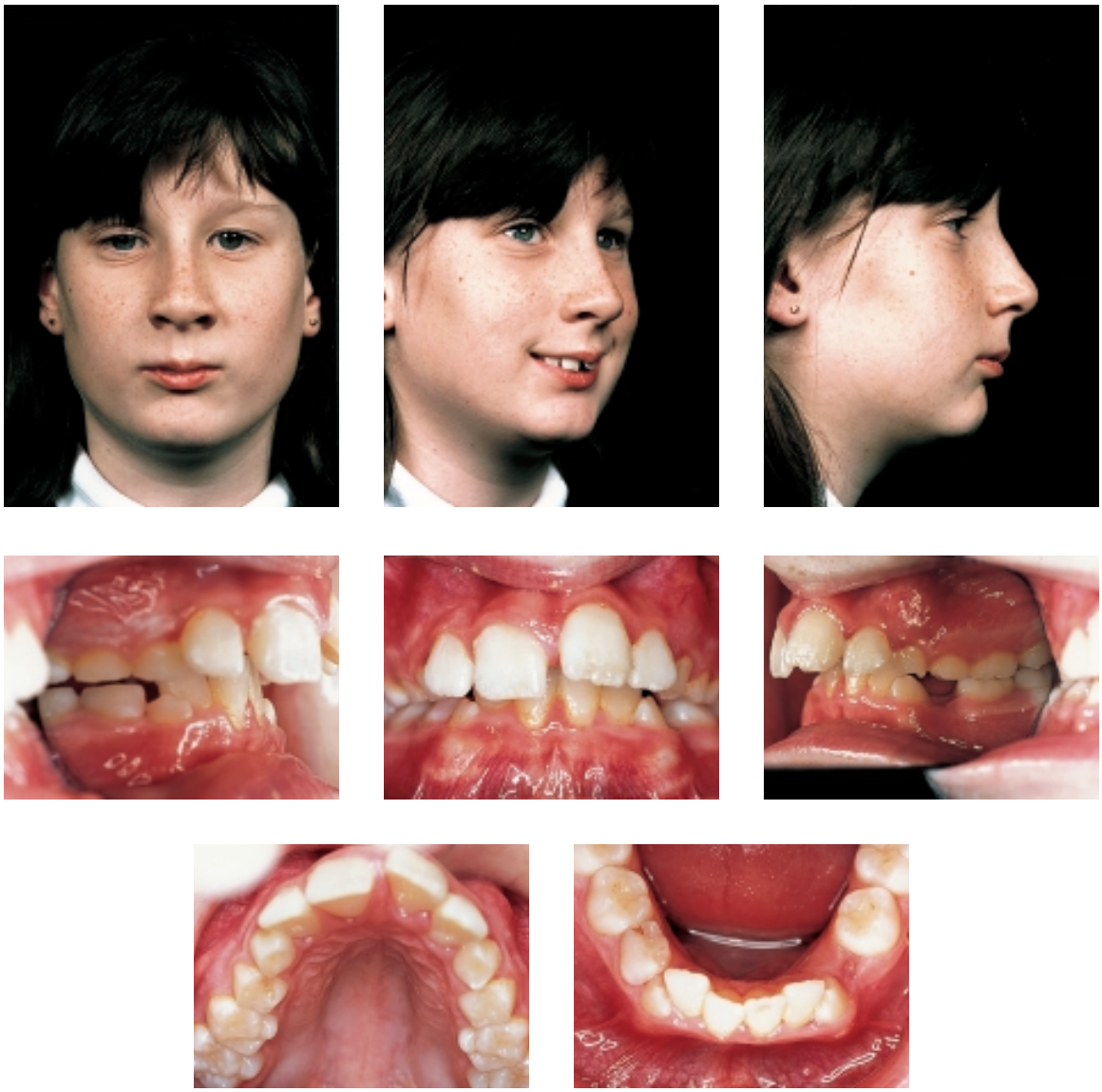

Fig. 4 (a–h) Case 2 at start.

Table 2 Cephalometric analysis

Parameter	Pre-treatment	End of functional	End of treatment	Change
SNA	82	81	80	–2
SNB	75	77	76	+1
ANB	7	4	4	–3
MMPA	27	27	28	+1
Upper incisor to maxillary plane	126	116	114	–12
Lower incisor to mandibular plane	87	92	90	+3
Lower incisor to A-Po line	–3 mm	+1 mm	0 mm	+3 mm
Inter-incisal angle	120	124	127	+7
Lower face height percentage	51	53	54	+3

retrusive to the aesthetic line of APo. The cephalometric values are shown in Table 2.

There is a multi-factorial aetiology to this malocclusion involving an inherited anteroposterior and vertical skeletal discrepancy, a soft tissue contribution of the lower lip exacerbating the proclination of the upper incisors, and a tooth size/arch length discrepancy. The index of treatment need was 5a and the pretreatment PAR score was 35.

The aims of treatment were to:

- Improve the facial profile.
- Correct the anteroposterior and vertical skeletal discrepancies.
- Correct the overjet.
- Correct the molar relationship to Class I.
- Alleviate the crowding, level and align the dentition.

A two-phase treatment plan was adopted in order to correct the patient's malocclusion:

Phase 1

- Functional appliance treatment using a Function Regulator—Type 2.

Phase 2

- Extraction of all four second premolars.
- Nance palatal arch to help enhance anchorage.
- Upper and lower pre-adjusted edgewise appliances (0.022 × 0.028-inch) using Andrew's prescription brackets and molar bands.
- Upper and lower Hawley retainers.

The first phase of treatment was commenced with a Type 2 Function Regulator (Figure 5). The vertical opening was approximately 5 mm and the mandible was postured forwards by the same amount. The patient initially wore the appliance in the evenings after school and during the day at weekends. The duration of wear was gradually increased to full time over the following month. Eight months into treatment the appliance was reactivated to bring the incisors to a Class I relationship. The appliance was worn full time for a further 8 months during which time the overjet reduced to 3 mm on the right side and 4 mm on the left. Although an over-correction was not achieved, it was decided to commence fixed appliance treatment. The buccal segments were in a Class I relationship and the residual overjet was accepted due to the tooth size discrepancy. The amount of crowding in the lower arch was 4mm, which combined with the 5 degrees proclination of the lower labial segment from the functional appliance phase of treatment indicated that extraction of lower second premolars was appropriate. This was matched with the extraction of the upper second premolars, and the use of a transpalatal arch to enhance anchorage. Subsequent to cementation of the transpalatal arch, upper and lower fixed appliances were placed using the Andrew's prescription 0.022 × 0.028-inch slot size. Initial alignment was undertaken using nickel-titanium archwires, prior to consolidating the labial segments on 0.018-inch ss archwires. Space closure was commenced in 19/25-inch ss archwires, with the transpalatal arch *in situ*, which was removed after two visits of intra-arch traction. This helped to ensure

Fig. 5 Type 2 function regulator.

that anchorage was conserved and eliminated any need for Class II inter-maxillary traction, which may have resulted in further proclination of the lower labial segment. Total treatment time was 34 months and following debond (Figure 6a–h), upper and lower Hawley-style retainers, with close fitting labial acrylic, were provided.

Case assessment

The benefits of functional appliances, in appropriate cases, have been illustrated in the literature by many authors. In this case, the attempt to alter the muscular environment, in particular in the region of the mentalis muscle attachment, through the use of the Function Regulator type 2 appliance, has helped in producing the desired result.

The degree of skeletal improvement was moderate, despite the good compliance of the patient. This was due to growth changes occurring primarily in a vertical direction, as is indicated in the cephalometric superimposition (Figure 7).

Consideration of inter-proximal stripping as an alternative to extractions was rejected due to the Bolton discrepancy. The post-treatment cephalogram indicated that the lower incisors had proclined by 3 degrees over the course of treatment. Considering the lower lip 'trap' that existed at the start of treatment, this degree of

Fig. 6 Case 2 at debond.

Fig. 7 Case 2: lateral cephalograms at start and debond.

proclination is likely to be a stable change. The 3 degrees reduction of the ANB angle has converted a moderate skeletal II pattern into a skeletal I pattern, and the 12 degrees reduction in upper incisor inclination has aided the correction of the incisor relationship. The post-treatment PAR score of 4 equates to an 89 per cent or 31 point reduction, which indicated the case is greatly improved.

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