Class II Division 1 treatment using a two-phase approach – a case report

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Abstract

The improvement of facial aesthetics is one of the main reasons why patients with a Class II Division 1 malocclusion seek orthodontic treatment. There are various techniques available to treat Class II malocclusions, one of which is a two-phase approach that includes functional jaw orthopaedics as well as fixed orthodontic treatment. The following case report describes a young growing female patient with a severe Class II Division 1 malocclusion. The patient was treated using the functional removable appliance called the Twin Block, for growth modification and correction of her overjet and profile, in the first phase. Thereafter, a fixed pre-adjusted self-ligating Damon orthodontic appliance was utilized in the second phase, to ensure well aligned arches and improved aesthetics and function.

Key words: Orthodontic treatment, Class II Division 1, Two-phase treatment, Functional appliance, Twin Block, Self-ligating brackets, Damon.

Introduction

Class II Division 1 malocclusion cases are often complicated due to a skeletal discrepancy involving the maxilla and mandible. It can be as a result of a retrusive mandible and/or a protrusive maxilla.[1] The most prevalent feature of this malocclusion in growing patients is mandibular retrusion.[2] Treatment of skeletal Class II cases depends on growth, age, compliance and the severity of the malocclusion.[3]

There are various ways to treat an Angle Class II Division 1 malocclusion, with treatment options including both removable and fixed appliances. Removable appliances can be removed by the patient and require good compliance, whereas fixed appliances are bonded onto the teeth and do not require patient compliance for placement and removal. Removable treatment options include functional appliances and, more recently, clear aligners. There are more fixed options available and include fixed class II correctors and fixed orthodontic treatment in conjunction with inter-arch elastics and/or extractions and/or skeletal anchorage and/or orthognathic surgery, depending on the severity of the case.

In patients with psychosocial problems due to poor facial aesthetics and an enlarged overjet, a two-phase or early management approach can be followed, where the patient starts treatment in the late mixed dentition by making use of functional appliances, followed by the second phase where fixed appliances are used to finish the treatment in the permanent dentition. The use of a single phase or late treatment is advocated in cases where the patient has finished growing and treatment only commences in the permanent dentition with fixed appliance treatment.[4]

Various types of functional appliances exist and are designed to alter the activity of various muscle groups that influence the position and function of the mandible. By altering the vertical and sagittal position of the mandible, the muscle forces can result in orthodontic and orthopaedic changes in the dentition.[5]

The development of functional appliances originated in 1879 through Norman

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Figure 1 (a-h): Pre-treatment photographs.

Kingsley, who first introduced the bite-jumping appliance. Kingsley's appliance was a maxillary plate that acted by guiding the mandible forward during closure. In the early 1900's, development in both the United States and Europe began with functional and fixed orthodontic techniques. The Monobloc of Robin, developed in 1902, was considered the forerunner of removable functional appliances. However, Andresen's Activator, developed in the 1920s in Norway, was considered to be the first functional appliance to be widely accepted.[6]

Various functional appliances have been developed over the years mainly to correct Class II malocclusions by altering the soft tissues surrounding the teeth, causing a disruption in the occlusion and creating an inter-maxillary force.[8]

Functional appliances serve as a potentially successful treatment modality when used in growing patients diagnosed with a skeletal Class II Division 1 malocclusion due to a retrusive mandible.[1] Adequate compliance by the patient is necessary. Orofacial functional therapy can be used alone or in conjunction with other forms of therapy.[7]

The rational understanding that exists between environmental and genetic views in the context of the functional appliance and its potential to influence mandibular growth remains that there is a predetermined mandibular growth potential. The temporary acceleration of growth that is achieved with functional appliances does not have the potential to increase mandibular length or ramus height beyond that which is already genetically determined.[9]

Functional appliances can however result in dramatic Class II correction through dentoalveolar retroclination of the maxillary teeth and proclination of the mandibular teeth. They disclude the maxilla from the mandible and restrict maxillary growth. All these changes contribute to the establishment of a new occlusion while the patient is growing.[8]

Since William Clark originally developed the Twin Block appliance in 1982,[7] it has been reported to be very effective

Figure 2 (a-b): Pre-treatment extraoral photographs showing a hyperactive mentalis (a) and a lower lip trap (b).

in treating Class II Division 1 cases in growing patients.[6] The Twin Block appliance is composed of acrylic removable plates containing acrylic bite blocks. These bite blocks connect at 70 degrees when the patient closes his/her mouth, while posturing the position of the mandible forward.[10]

The dramatic results often seen after wearing functional appliances are due to dentoalveolar movement. Maxillary teeth are tipped distally and mandibular teeth mesially. The appliances tend to restrict maxillary growth while establishing a new occlusal relationship in a patient that is actively growing.[8]

The perfect treatment timing of Class II malocclusions appears to be during or shortly after the start of the pubertal growth spurt.[11] Detecting the pubertal growth spurt of mandibular growth is the best diagnostic tool for treatment planning in patients with a Class II malocclusion that is due to a mandibular deficiency. Of the various ways of determining the pubertal growth spurt of a patient, the Fishman's hand wrist analysis and Cervical Vertebral maturation are the most popular.[12] The bodies of the second, third and fourth cervical vertebrae can be analysed to determine growth of the patient and divided into six maturation stages. This method is preferred because it is performed on a lateral cephalogram - one of the diagnostic x-ray photos taken routinely for all orthodontic cases.[13] Whilst the use of growth indicators remains controversial, the hand wrist analysis remains one of the most reliable methods due to its assessment of ossification events and not the use of single stages. No growth indicator has been found to have a full diagnostic reliability in determining the pubertal growth spurt, but their use is still recommended for increasing efficiency of functional appliance treatment in Class II malocclusions.[14]

In some cases, functional treatment can achieve good results, but most often a second phase using fixed orthodontic appliances is necessary for treating any remaining discrepancies and to ensure proper interdigitation of the teeth in their new positions.

Case report

A 10-year-old female patient (Figures 1 a-h) presented to a private practice with the main complaint that her front teeth stand out and she is made fun of at school. The patient requested treatment to improve her appearance. Nothing abnormal was detected in her medical history and she had undergone a previous dental consultation one year prior to her initial visit.

Upon clinical examination the patient presented with a Class II Division 1 malocclusion. Extra-oral examination revealed that the patient was brachycephalic with a severely convex profile and a posterior facial divergence. She had good facial symmetry and her maxillary midline was co-incident with her midsagittal plane. She presented with incompetent lips and a hyperactive mentalis muscle with a lower lip trap.

Intra-oral examination revealed that the patient was in her transitional dentition stage. She had healthy gingiva with a swollen papilla between teeth 11 and 21and had an Angle Class II molar classification bilaterally. In occlusion she had

an overjet of 15 mm and an overbite of 9/10 (90%). There was spacing of the maxillary incisor teeth and mild crowding of the mandibular incisors.

The functional examination revealed that the patient had a history of thumb sucking and mouth breathing habits. Her incompetent lips and enlarged overjet resulted in a lower lip trap and hyperactive mentalis activity (Figures 2 a and b).

Radiographic findings

The radiographic analysis of the patient's initial orthopantomogram showed a second transitional stage with the canines and premolars erupting, with no other abnormalities (Figure 3).

The cephalometric analysis (Table 1), conducted before treatment, revealed a Class II skeletal relationship. Figures 4 (a and b), show the pre-treatment cephalogram and the cephalometric analysis done with Dolphin® orthodontic software.

Diagnosis

Soft tissue

The patient presented brachycephalic with a severely convex profile, posterior divergence, lower lip wedge and a Class II lip relationship.

Skeletal

Class II skeletal malocclusion [Steiner - ANB (8.6°) and WITS (7.6 mm)] with a retrognathic mandible [SNB (71.0°) and Facial angle (85.4°)] and a normal growth pattern.

Figure 3: Pre-treatment orthopantomogram

Dental

Angle Class II Division 1 with maxillary incisors proclined and protrusive and mandibular incisors retrusive. An overbite of 9/10 and an Overjet of 15mm due to the proclined maxillary incisors and retruded mandible position.

Treatment objectives

The treatment objectives of the first phase of treatment in this case were, primarily, to reduce the enlarged overjet and improve the facial appearance and self-confidence of the patient. A further objective was to improve the deep bite and achieve a Class I molar and canine relationship. The final objective was the normalising of the musculature by eliminating the lower lip trap and hyperactive mentalis muscle.

The second phase objective was to resolve any residual crowding, ensure good interdigitation, settle the teeth in their new positions and ensure a functionally acceptable result.

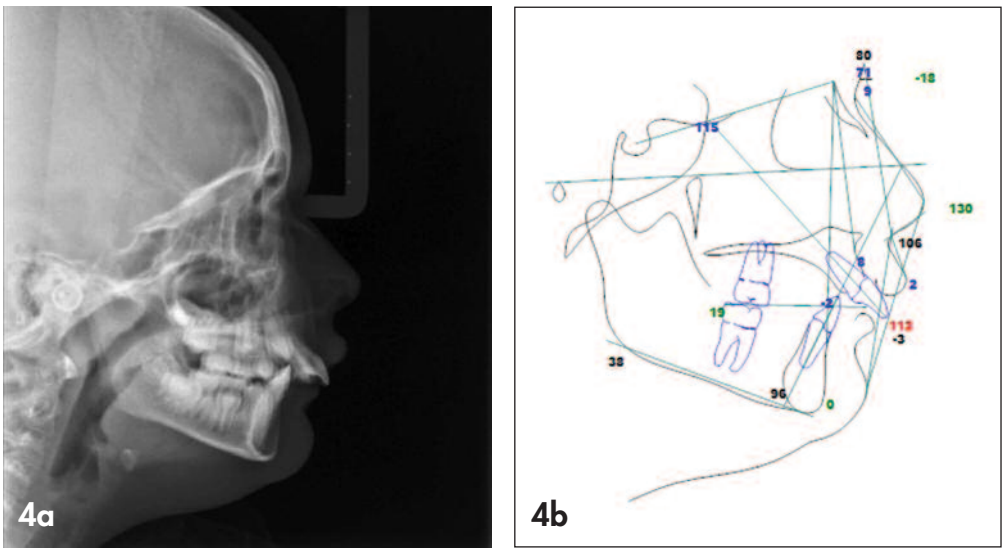

Figure 4: (a) Pre-treatment cephalogram and (b) cephalometric analysis.

Table 1. Pre-treatment cephalometric analysis

Cephalometric values	Normal	Pre - Treatment
SNA (°)	82.0	79.6
SNB (°)	80.9	71.0
ANB (°)	1.6	8.6
WITS (mm)	-1.0	7.6
Interincisal angle (°)	130.0	111.7
U1 – SN (°)	102.4	114.6
U1 – NA (mm)	4.3	6.7
U1 – NA (°)	22.8	35.0
L1 – NB (mm)	4.0	2.9
L1 – NB (°)	25.3	24.7
FMIA (L1 – FH) (°)	63.5	60.9
IMPA (L1 – MP) (°)	95.0	96.1
Lower lip to E-Plane (mm)	-2.0	-3.1
Upper lip to E-plane (mm)	-3.3	1.7
Soft tissue convexity (°)	135.7	129.6
Convexity (A-NPo) (mm)	1.5	7.6
Nasolabial angle (°)	102.0	105.9
Facial angle (°)	87.2	85.4
Upper lip thickness at A-point (mm)	17.0	10.9
Upper lip thickness at Vermilion border (mm)	13.1	9.4

Treatment options

There are various ways to treat an Angle Class II Division 1 malocclusion. The treatment options include both removable and fixed options and can be done in one or two phases.

In one phase treatment the patient is treated once all permanent teeth have erupted and makes use of fixed orthodontic treatment in conjunction with inter-arch elastics, extractions and sometimes fixed functional correctors. In two phase treatment a removable functional appliance is placed in the mixed dentition for growth modification and followed with fixed treatment as a second phase.

The treatment options for this case can be categorised as either growth modification, camouflage or surgical correction.

- *Growth modification* by making use of functional appliances as a first phase and fixed orthodontic treatment in the second phase if necessary.
- *Camouflage treatment* which include fixed orthodontic treatment in conjunction with inter-arch elastics and/or extractions and/or skeletal anchorage.
- *Surgical correction* which includes a combination of fixed orthodontic treatment and orthognathic surgery that can only be done after the age of 18.

Treatment plan

The two-phase treatment - Growth modification (Twin Block) and fixed orthodontic treatment. The following steps were followed for the chosen treatment plan:

First phase:

1. Complete all necessary basic restorative dentistry.
2. Scale and polish and oral hygiene instructions.
3. Take impressions for the fabrication of the functional removable appliance (Twin Block).

Figure 5 (a-c): Twin Block in place.

Figure 6: T4K Orthodontic trainer appliance.

4. Make use of the removable appliance to improve the overjet, expand the maxillary arch and obtain a Class I molar and canine relationship.

Second phase:

5. Fixed orthodontic treatment using the Damon self-ligating orthodontic system.
6. The fixed orthodontic treatment used to resolve any residual crowding and to improve interdigitation of the permanent teeth in order for them to settle in the new Class I position.
7. Retention – Permanent fixed mandibular retainer and removable maxillary and mandibular clear retainers to be worn at night.

First Phase – Twin Block

The initial placement of the Twin Block with the posturing of the mandible showed early improvement of the patient's profile and appearance and motivated her to wear it. There was soft tissue strain present with the large amount of posturing necessary to position the mandible into a better position when the appliance was first placed (Figure 5 c). The amount of soft tissue strain is normal after initial Twin Block placement in a severe Class II case with a severe overjet. The strain improves with the dentoalveolar retrusion of the maxillary and protrusion of the mandibular anterior teeth throughout treatment.

The lower appliance incorporated a labial bow with acrylic coverage to inhibit the excessive proclination of the lower incisors, (Figure 5a and b). The patient was instructed to wear the Twin Block at all times and to only remove it in order to clean it. A mid-palatal expansion screw was incorporated in the maxillary appliance and the patient was instructed to perform a ¼ turn twice per week. The maxillary arch in most Class II Division 1 cases is constricted and requires expansion. This expansion is also necessary to ensure that bilateral posterior crossbites do not develop with the forward positioning of the mandible. The patient struggled with the Twin Block appliance at first but showed excellent compliance and persisted in wearing the appliance for the rest of the first phase of treatment.

The total treatment time of the Twin Block was 12 months. After the Twin Block treatment, the patient was given a T4K™ (Trainer for Kids, Myofunctional Research Co, Australia)

Table 2. Cephalometric analysis after first phase of treatment

Cephalometric values	Normal	Pre - Treatment	After phase one (Twin Block)
SNA (°)	82.0	79.6	78.8
SNB (°)	80.9	71.0	74.0
ANB (°)	1.6	8.6	4.8
WITS (mm)	-1.0	7.6	0.2
Interincisal angle (°)	130.0	111.7	120.3
U1 – SN (°)	102.4	114.6	95.8
U1 – NA (mm)	4.3	6.7	3.3
U1 – NA (°)	22.8	35.0	17.0
L1 – NB (mm)	4.0	2.9	7.1
L1 – NB (°)	25.3	24.7	37.8
FMIA (L1 – FH) (°)	63.5	60.9	48.9
IMPA (L1 – MP) (°)	95.0	96.1	105.0
Lower lip to E-Plane (mm)	-2.0	-3.1	-0.4
Upper lip to E-plane (mm)	-3.3	1.7	-1.9
Soft tissue convexity (°)	135.7	129.6	132.9
Convexity (A-NPo) (mm)	1.5	7.6	4.3
Nasolabial angle (°)	102.0	105.9	116.4
Facial angle (°)	87.2	85.4	86.5
Upper lip thickness at A-point (mm)	17.0	10.9	12.9
Upper lip thickness at Vermilion border (mm)	13.1	9.4	9.9

orthodontic trainer appliance (Figure 6) to sleep with until all permanent teeth were erupted and in occlusion. The T4K appliance is a polyurethane pre-fabricated functional appliance.[15] The decision to use the T4K appliance was to promote uninhibited eruption of the permanent posterior teeth after the Twin Block phase. The absence of acrylic and retentive clasps was the motivating factor for using the appliance. The T4K, the author's preference, is not as rigid as the Twin Block and allows further growth in an anteroposterior and transverse direction. Another effective technique is to allow the patient to continue to wear the Twin Block appliance at night with a modification of the upper acrylic inclined blocks to allow for the eruption of the posterior teeth. A further option is to construct a maxillary Hawley appliance with an anterior inclined plane, also to be worn at night until all posterior teeth are in occlusion.

After the first phase of treatment with the Twin Block, the following cephalometric values were noted (Table 2). Figures 7a and b show the cephalogram and the cephalometric analysis done directly after the Twin Block treatment. The clinical photos taken directly afterwards are shown in Figures 8 a-h. At this stage in the treatment the patient no longer had to posture the mandible into a more favourable position. Each time the patient closed her mouth, the mandible was in the same position with very little lip strain.

The lateral open bites seen after the first phase of treatment occurred as a result of the restraint of eruption of the posterior teeth due to the occlusal blocks and unimpeded incisal eruption and vertical growth. It is indicative of the patient's compliance in wearing the appliance. Once the overjet is reduced the upper acrylic occlusal blocks are trimmed for the lower first molars to erupt and close the open bites. While the lateral open bites close spontaneously, acrylic trimming is advocated to limit the chance of relapse and to ensure

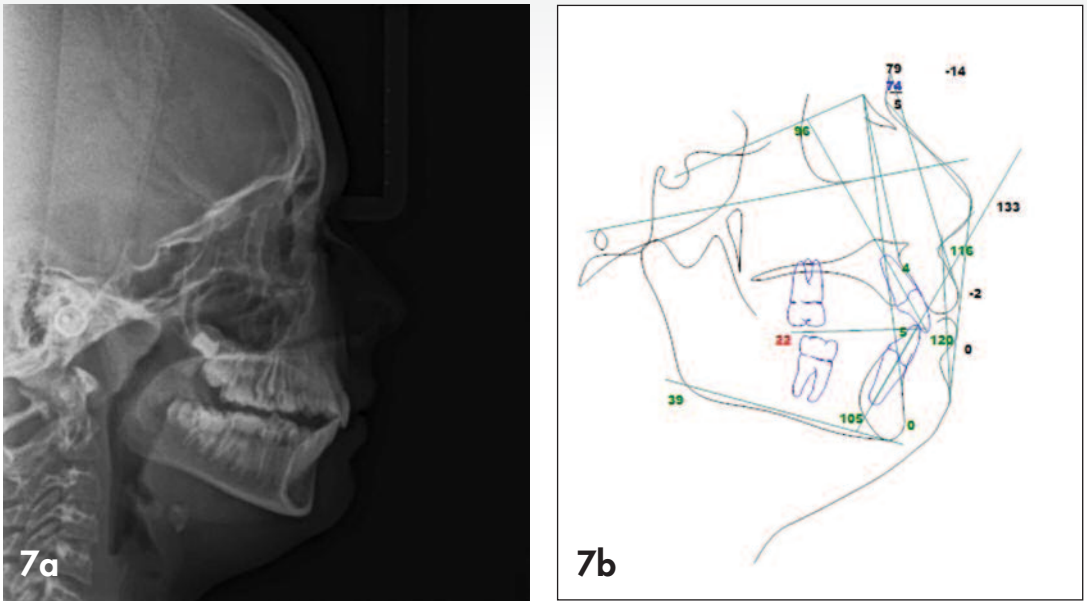

Figure 7: (a) Cephalogram after Twin Block phase and (b) cephalometric analysis after Twin Block phase.

good occlusion post treatment.[16]

The changes seen after treatment are the result of the posturing of the mandible forward together with dentoalveolar changes that occurred.

During the retention period after the Twin Block treatment the posterior occlusion settled in the new position. Although the molars and canines were in a Class I position, there was still mild dental crowding present (Figures 9 a-h).

There was a lack of sufficient transverse expansion with the Twin Block after the first phase of treatment. The required expansion was one of the objectives of the second phase of the treatment and was achieved through use of the broad Damon Copper Nickel Titanium archwires. Resolving the residual crowding, improving the interdigitation of the teeth in their new positions and ensuring a functionally acceptable result were the other objectives of the second phase of treatment. This was achieved using the Damon self-ligating fixed orthodontic appliance. Treatment time for the second phase with fixed orthodontic treatment was 12 months.

Table 3. Archwire sequence used for second phase of treatment

Maxilla	Mandible
0.014 CuNiTi	0.014 CuNiTi
0.014 x 0.025 CuNiTi	0.018 CuNiTi
0.014 x 0.025 CuNiTi	0.014 x 0.025 CuNiTi
0.018 x 0.025 CuNiTi	0.018 x 0.025 CuNiTi
0.016 x 0.025 SS	0.019 x 0.025 TMA

Second Phase – Fixed appliance treatment

The Damon self-ligating pre-adjusted orthodontic system was used to conduct the second phase of treatment (Figures 10 a-e). Alignment was done using Copper Nickel Titanium (CuNiTi) archwires and the case was finished on stainless steel (SS) and titanium molybdenum alloy (TMA) wires. The archwire sequence that was used is shown in Table 3 .

The final archwire for the lower arch was a 0.019 x 0.025 TMA. This archwire was used so that a reverse curve of Spee could be bent in order to further open the bite, plus its increased flexibility has better patient tolerance, making it easier for the clinician to work with.

The final archwire for the upper arch was a 0.016 x 0.025 SS. Conventionally the final wire would have been a 0.019 x 0.025 SS, but the decision was made after clinical evaluation of the maxillary anterior teeth that the final archwire of 0.016 x 0.025 SS would be adequate. A further increase in torque would have resulted in an even smaller interincisal angle with the already proclined lower incisors. Clinically, the torque of the maxillary incisors was evaluated and thought to be adequate. No inter-arch Class II elastics were used during the second/fixed orthodontic phase of treatment. The patient had a stable Class I bite from

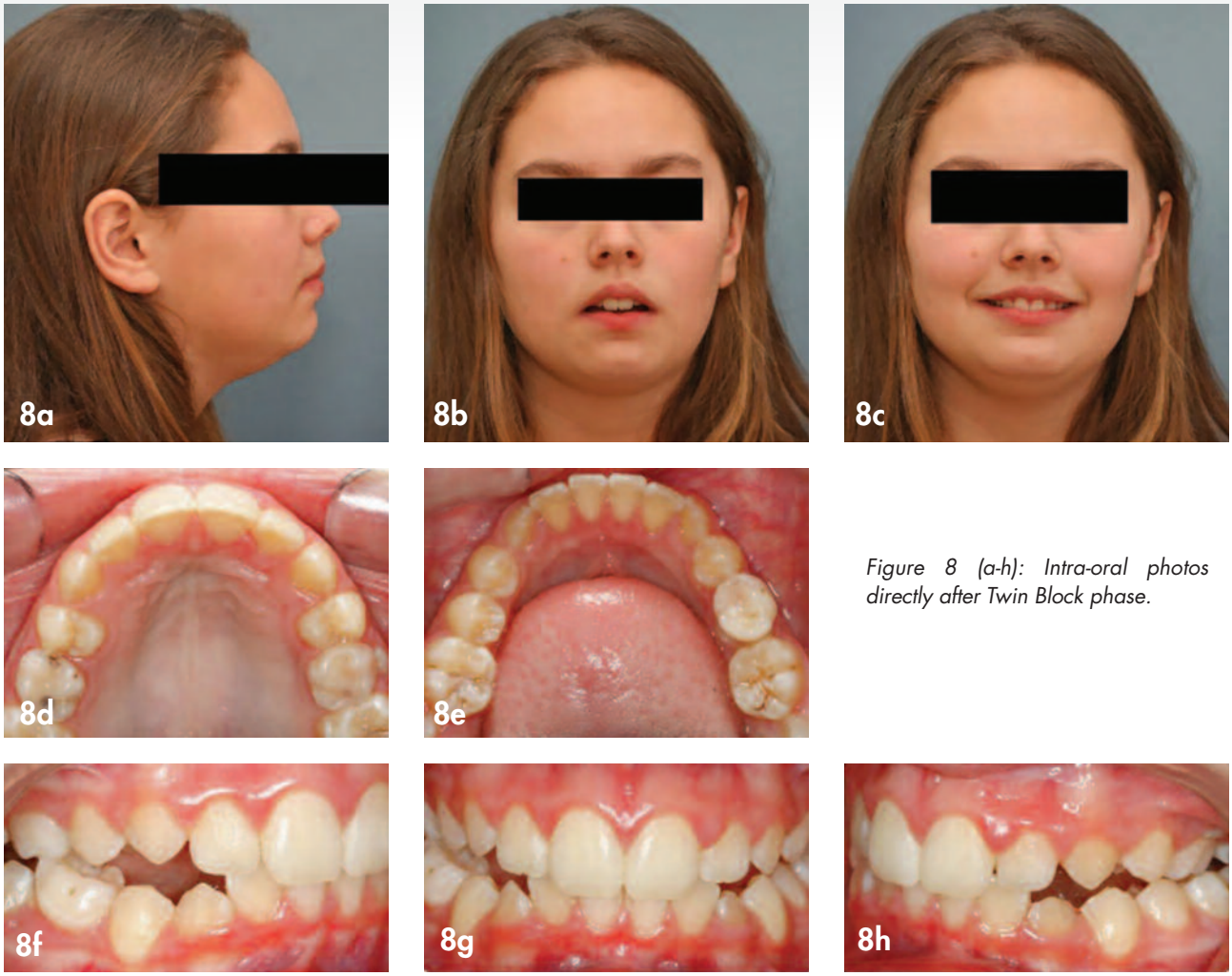

Figure 8 (a-h): Intra-oral photos directly after Twin Block phase.

the end of the first phase throughout the rest of the treatment. This proved that the correction seen after the first phase was not due to posturing and that a new occlusal relationship had been established that was stable and reproducible without any strain. The only elastics that were used were for settling the teeth in their new positions (Ostrich 2 Oz, 19.1mm – ORMCO). This was done for the last two weeks prior to the removal of the braces.

Treatment outcome

The treatment resulted in well aligned arches with Class I molar and canine relationships (Figures 11 a-h). The upper midline corresponded to the patient's midsagittal plane and the teeth were settled in the new occlusion. The soft tissue profile improved and the lip trap and hyperactive mentalis that the patient presented with initially was resolved.

Superimposition

Superimposition was done of the pre- and post-treatment cephalometric analyses (Figure 12). The images were superimposed on the cranial base, maxilla and mandible. The initial cephalometric tracing is illustrated in black and the final tracing in green.

Cranial base superimposition: Shows the correction of the molar relationship from Class II to Class I. It also reveals the reduction in overjet and overbite as well as the improvement of the lip relationships from Class II to Class I. An increase in lower facial height and mesial movement of the mandibular first permanent molar into a Class I relationship is also shown.

Maxilla superimposition: Represents how the maxillary incisors retroclined throughout treatment, as well as the inferior movement as the maxillary first permanent molars with

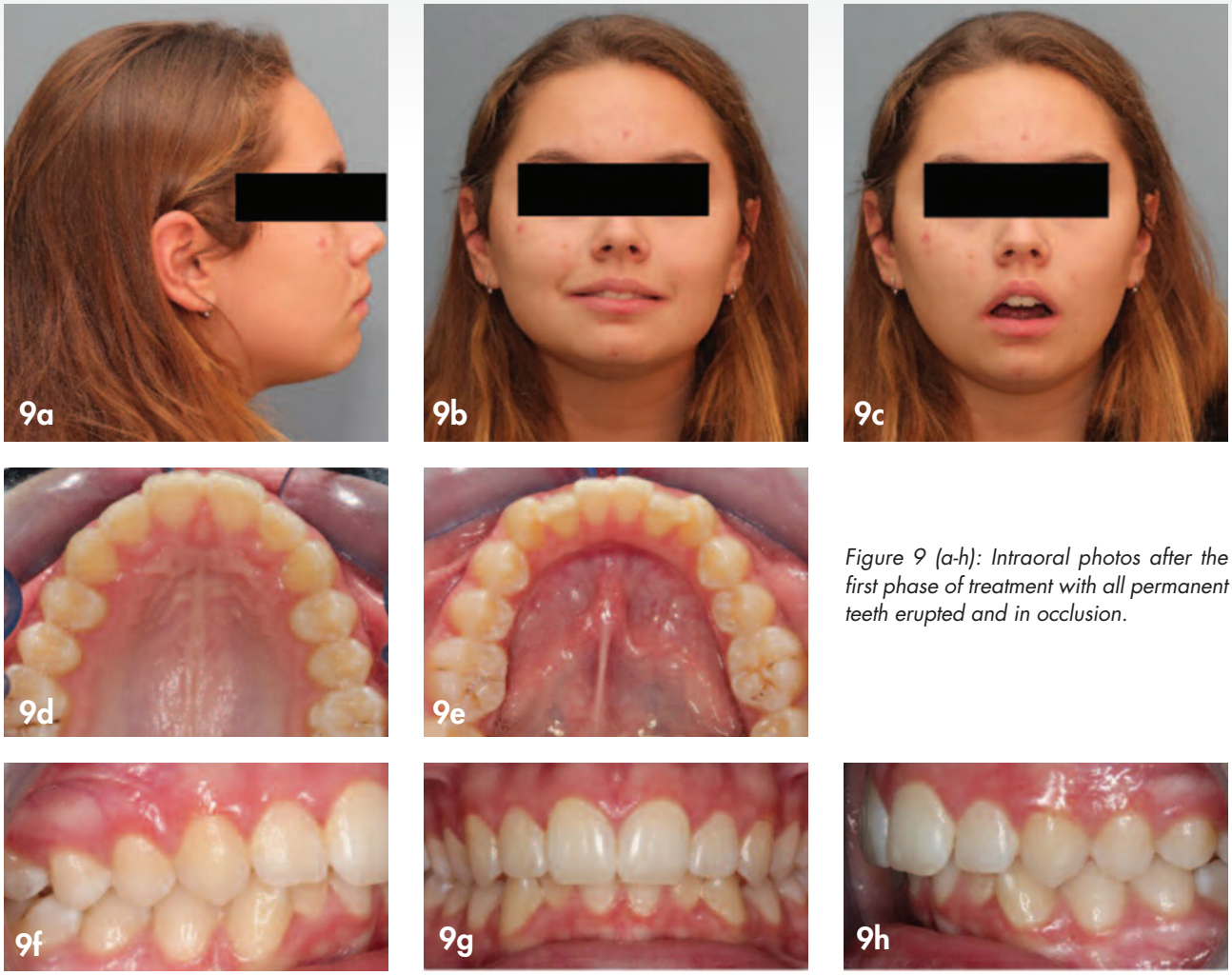

Figure 9 (a-h): Intraoral photos after the first phase of treatment with all permanent teeth erupted and in occlusion.

the over-eruption into the space available and opening of the bite. The eruption of the maxillary molars most likely occurred when the Twin Block was removed and the T4K appliance placed, since only the maxillary acrylic block was trimmed during the first phase of treatment with the Twin Block.

Mandible superimposition: Represents the proclination of the mandibular incisors that occurred during treatment as well as the superior movement of the mandibular first permanent molars during treatment. Mandibular changes can be seen in the vertical and horizontal direction.

The superimpositions show that the treatment objectives set out for this patient were achieved. These included a reduced overjet, deep bite correction, Class I molar and canine relationships, elimination of the lower lip trap and improved facial appearance.

Comparison of Initial and final orthodontic study models

A comparison was made of the pre-treatment and post-treatment orthodontic study models to show the change that occurred from all the different views (Figures 13 a-j).

Frontal view: Vertical and transverse correction showing deep bite correction and improved inclination and position of the posterior segments without any crossbites present (Figures 13 a and b).

Lateral views: Improvement in the anteroposterior dimension with a decreased overjet and correction of the Class II molar and canine relationships to Class I (Figures 13 c-f).

Maxillary and mandibular occlusal views: Well aligned arches without any residual spaces or rotations (Figures 13 g-j).

Cephalometric values

Table 4 shows the values of the cephalometric analyses from the start to the completion of treatment.

Discussion

Class II Division 1 treatment aims to correct the molar and canine relationship to Class I, reduce the overjet, improve the deep bite and ensure a functionally correct result with teeth settled in their new positions without any adverse effects on the temporomandibular joint.

Treatment of Class II Division 1 malocclusions should also be aimed at solving the dentoskeletal disharmony in order to obtain favourable facial aesthetics.[17] The use of a two-phase treatment approach can successfully treat growing patients and can drastically improve both function and aesthetics, ultimately resulting in improved self-confidence. The first phase requires compliance from the patient and is carried out using a removable functional appliance. The second phase is done using a fixed orthodontic appliance system. There is consensus that removable functional appliances can lead to improved facial appearance in Class II cases.[18] Functional appliances act by eliminating oral dysfunctions, re-establishing muscular balance and correcting maxillary incisor protrusion.[19] Functional appliances can result in dramatic Class II correction through dentoalveolar retroclination of the maxillary teeth and proclination of the mandibular teeth. They disclude the maxilla from the mandible and restrict maxillary growth. All these changes contribute to the establishment of a new occlusion while the patient is growing.[8]

The Twin Block, developed by William Clark is an example of a removable functional appliance. Twin Block therapy is widely accepted as a better alternative to the earlier bulky monobloc appliances when treating Class II Division 1 cases. The Twin Block appliance has a high rate of adaptability, acceptability, efficiency, versatility and the ease of advancing the mandible incrementally without having to change the appliance has made it the popular choice for correcting Class II malocclusions.[20] Early treatment with orthopaedic appliances is successful in 80% of cases with malocclusion and the remaining 20% require the use of fixed appliances.[21] Successful treatment of Class II Division 1 cases can prevent 1) possible trauma to maxillary incisors, 2) Tempero-mandibular joint dysfunction and 3) poor psycho-social adaptation.[22]

There still exists a lack of evidence that functional appliances can cause a significant effect on mandibular growth long term. Despite this lack of evidence, the use of functional appliances has been proven to be very effective for reducing the overjet in growing patients with Class II malocclusions. Functional appliances make use of dentoalveolar movement, altered soft tissue environment and

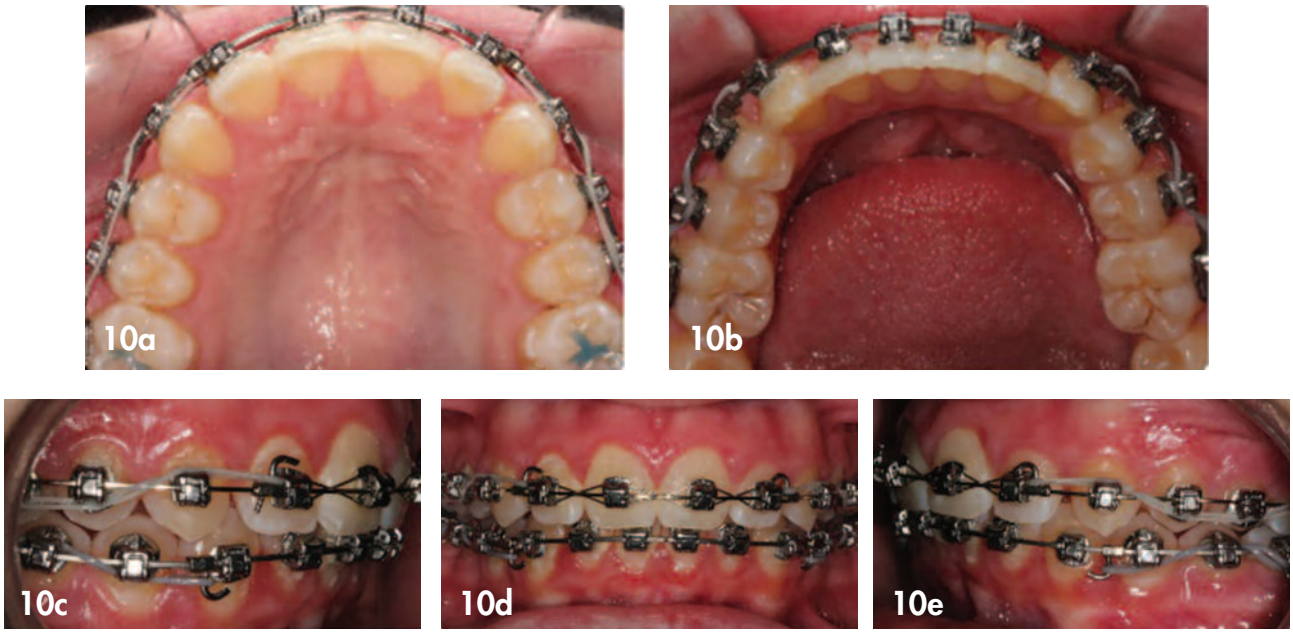

Figure 10 (a-e): Damon fixed orthodontic appliance treatment.

Figure 11 (a-h): Post-treatment photographs.

the greater growth potential of the mandible to successfully decrease the overjet in growing patients. Functional appliances require patient compliance and will therefore not be successful in all cases. Patient selection is of utmost importance to ensure successful treatment.[8]

Class II malocclusion correction should occur when the likelihood of the pubertal growth spurt is high.[13] It is important to consider that in mild to moderate skeletal Class II Division 1 cases, where active growth is complete, it is not possible to undertake growth modification treatment. The underlying skeletal discrepancy of some severe cases can be camouflaged by orthodontic treatment in conjunction with extractions. Adult patients with very severe discrepancies, should undergo orthodontic treatment in conjunction with orthognathic surgery.[23]

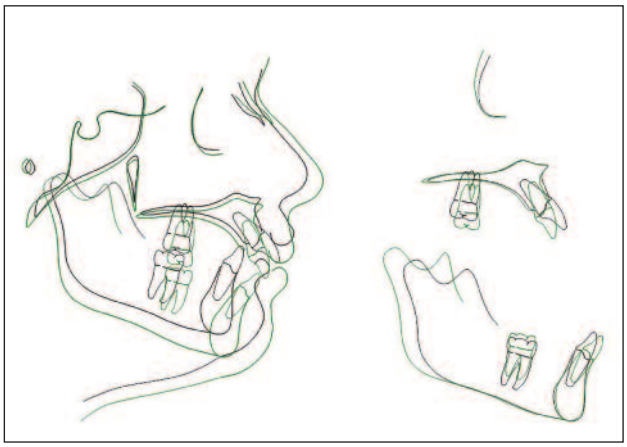

Figure 12: Cephalometric tracing superimposition in black (pre-treatment) and green (post-treatment).

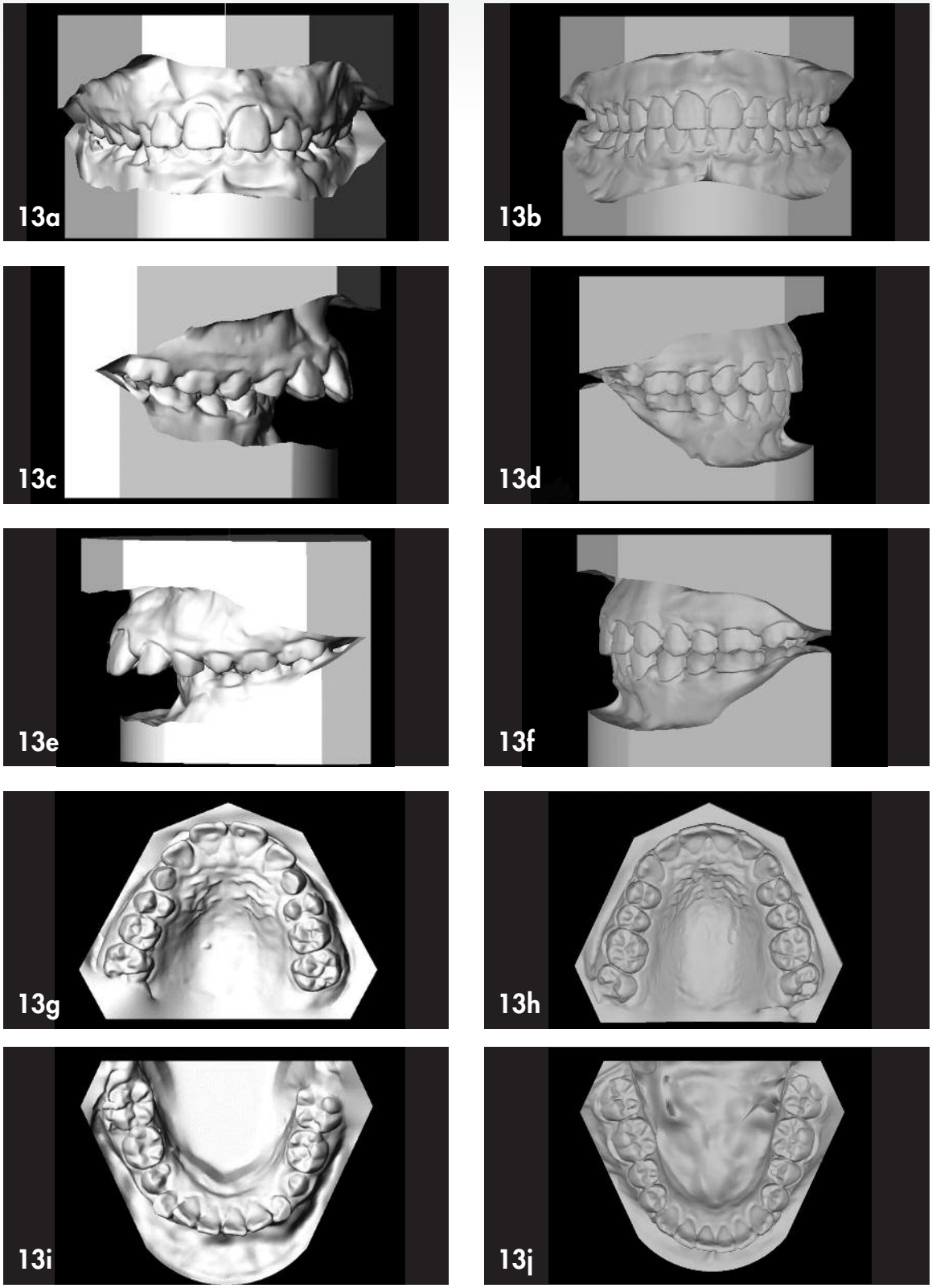

Figure 13 (a-j): Pre- and post-treatment orthodontic study models.

Table 4: Cephalometric values before and after treatment

Cephalometric values	Normal	Pre - Treatment	Post treatment
SNA (°)	82.0	79.6	77.7
SNB (°)	80.9	71.0	72.6
ANB (°)	1.6	8.6	5.2
WITS (mm)	-1.0	7.6	1.3
Interincisal angle (°)	130.0	111.7	124.9
U1 – SN (°)	102.4	114.6	93.2
U1 – NA (mm)	4.3	6.7	2.9
U1 – NA (°)	22.8	35.0	15.5
L1 – NB (mm)	4.0	2.9	6.9
L1 – NB (°)	25.3	24.7	34.5
FMIA (L1 – FH) (°)	63.5	60.9	53.1
IMPA (L1 – MP) (°)	95.0	96.1	103.0
Lower lip to E-Plane (mm)	-2.0	-3.1	-0.9
Upper lip to E-plane (mm)	-3.3	1.7	-2.5
Soft tissue convexity (°)	135.7	129.6	126.2
Convexity (A-NPo) (mm)	1.5	7.6	5.2
Nasolabial angle (°)	102.0	105.9	119.0
Facial angle (°)	87.2	85.4	86.9
Upper lip thickness at A-point (mm)	17.0	10.9	14.6
Upper lip thickness at Vermilion border (mm)	13.1	9.4	11.2

Conclusion

- The two-phase approach will not always be successful and unfortunately its success is not readily predictable.
- A successful two-phase approach in Class II Division 1 cases has the potential to prevent the removal of bicuspids to treat the malocclusion.
- The improvement in facial aesthetics caused by the functional treatment significantly improved the patient's self-confidence even if it was only dentoalveolar movement that occurred.
- The success of this case would not have been possible without the compliance of the patient in the first phase of treatment.
- If a one phase fixed orthodontic treatment was done for this patient she would have had to wait another 2 years for all her permanent teeth to erupt before any difference could have been made to her facial aesthetics and confidence.

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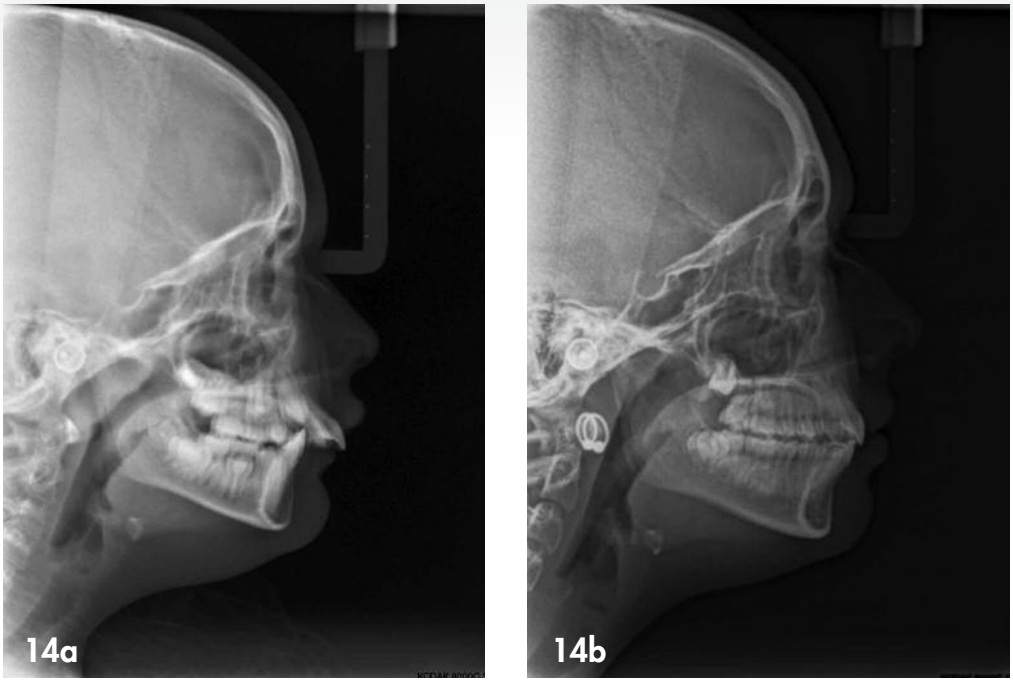

Figure 14 (a and b): Cephalograms before treatment (a) and after treatment (b).

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