Class II Division 2 deep bite treatment using a combination of fixed orthodontic appliances and an acrylic splint

Johan Christian Julyan[1] and Marius Coetsee[2]

Abstract

This case report describes the management of a 15 year old female patient that presented with a Class II Division 2 malocclusion and a severe deep bite. Intra-oral examination showed severely retroclined incisors and a unilateral posterior crossbite. Other findings included a deep curve of Spee and moderate crowding in the maxilla and mandible. The treatment plan made use of a pre-adjusted fixed MBT bracket system with the use of a removable acrylic splint in the mandible to facilitate bite opening for the first 6 months of treatment. A non-extraction treatment protocol was used to prevent any further deepening of the bite. The treatment resulted in improvement of the deep bite and incisor angulation as well as a Class I molar and canine relationship with improved function and aesthetics.

Keywords: Orthodontic treatment, Class II Division 2, Deep bite, Acrylic splint, Fixed orthodontic treatment

Introduction

Class II malocclusions are very common and can be subdivided into Class II Division 1 or Class II Division 2. Both divisions have their own set of clinical appearances and treatment difficulties. Characteristics of Class II Division 2 malocclusions include: retroclination of two or more of the maxillary incisors; retroclined mandibular incisors; a Class II molar relationship and an increased overbite or deep bite (vertical overlap of the maxillary incisors to the mandibular incisors). A very important feature of Class II Division 2 malocclusions is the high position of the lower lip in relation to the maxillary incisors contributing further to the retroclination of the maxillary incisors.[1]

The majority of Class II Division 2 malocclusions present with a deep bite.[2] A deep bite is however not limited to Class II Division 2 cases and is seen as a characteristic of many other malocclusions. Deep bites can be as a result of over erupted maxillary incisors, over erupted mandibular incisors, or a combination of both. In many of the patients that present with a deep bite the incisors are retroclined.[3] Underdevelopment of the mandible is seen in most Class II Division 2 cases and flaring of the mandibular anterior teeth and retroclination of the maxillary anterior teeth results due to a compensatory mechanism.[4] In Class II Division 2 cases the main complaint typically includes the increased vertical overlap of the incisors, crowding of the maxillary and mandibular arches and decreased overjet.[5]

The treatment success lies in correcting the antero-posterior, vertical and transverse discrepancies. Correcting the inter-incisal angle is also paramount for a stable long term result.[6] Potential treatment alternatives for Class II Division 2 malocclusion include maxillary molar distalisation, extraction of maxillary first premolars and mandibular second premolars or extraction of only first premolars in the maxilla.[7] Overbite reduction

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

is often critical to correct the incisor relationship of Class II Division 2.[8] Overbite reduction can be achieved by incisor intrusion or by extrusion of the buccal segments with minimal intrusion and proclination of the incisors.[9]

Different treatment options exist for the correction of Class II Division 2 malocclusions depending on the baseline presentation. Removable appliances can be used during the growth phase and in the post-adolescent phase the treatment aims to achieve dentoalveolar compensation with the use of fixed orthodontic appliances.[10,11,12,13] When the maxilla is the cause of the malocclusion, distalization of the maxillary teeth or extraction treatment is often considered.[14,15,16] Other techniques include the use of intermaxillary elastics or fixed rigid or flexible bite jumping Class II correction appliances.[17,18,19,20,21,22] Another option includes the use of orthodontic treatment in combination with orthognathic surgery.[23]

Class II Division 2 malocclusion treatment in an adolescent patient can often lead to an excellent result if growth, compliance and treatment mechanics are favourable.[24]

Case Report

A 15-year-old female patient (Figures 1 a-h) presented to private practice with a main complaint that she "doesn't like her front teeth". Nothing abnormal was detected in her medical history.

Upon clinical examination the patient presented with a Class II Division 2 malocclusion with a very deep bite. Extra-oral examination revealed that the patient was brachycephalic with a convex profile. She had good facial symmetry and her maxillary midline was co-incident with her mid sagittal plane. She presented with competent lips.

Figure 2: Pre-treatment orthopantomogram.

Intra-oral examination revealed that the patient was in her permanent dentition stage. She had healthy gingiva but buccal caries on tooth 45. She had an Angle Class II molar and canine relationship bilaterally. In occlusion she had an overjet of 1 mm and an increased overbite, also referred to as a deep bite or deep overbite. There was a unilateral posterior crossbite (26:36) and moderate crowding in the maxilla and mandible with retroclined incisors.

Radiographic findings

The radiographic analysis of the patient's initial orthopantomogram showed a permanent dentition stage with the maxillary and mandibular second molars erupting. There were also early signs of impacted third molars in the mandible but no other abnormalities. (Figure 2).

The cephalometric analysis (Table 1), conducted before treatment, revealed a Class II skeletal relationship. Figures 3 (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 convex profile.

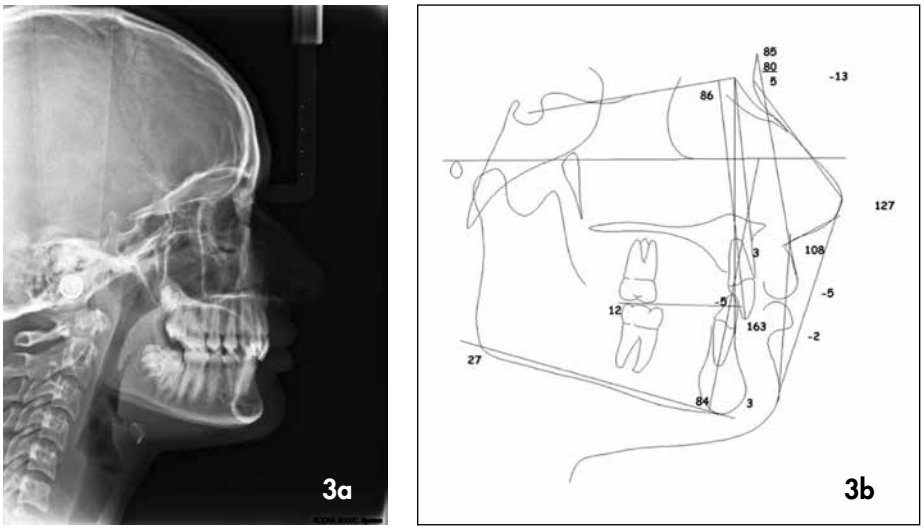

Figure 3: (a) Pre-treatment cephalogram and (b) cephalometric analysis.

Table 1: Pre-treatment cephalometric analysis

Cephalometric values	Normal	Pre - Treatment
SNA (°)	82.0	85.3
SNB (°)	80.9	79.8
ANB (°)	1.6	5.6
WITS (mm)	-1.0	3.8
Interincisal angle (°)	130.0	163.2
U1 – SN (°)	102.4	85.9
U1 – NA (mm)	4.3	-4.0
U1 – NA (°)	22.8	0.6
L1 – NB (mm)	4.0	-0.8
L1 – NB (°)	25.3	10.7
FMIA (L1 – FH) (°)	63.5	78.9
IMPA (L1 – MP) (°)	95.0	84.1
Lower lip to E-Plane (mm)	-2.0	-2.5
Upper lip to E-plane (mm)	-3.3	-4.8
Soft tissue convexity (°)	135.7	127.3
Convexity (A-NPo) (mm)	1.5	3.2
Nasolabial angle (°)	102.0	107.9
Facial angle (°)	87.2	91.4
Upper lip thickness at A-point (mm)	17.0	11.4
Upper lip thickness at Vermilion border (mm)	13.1	14.2

Skeletal

Class II skeletal malocclusion [Steiner - ANB (5.6°) and WITS (3.8)] with a prognathic maxilla [SNA (85.3°) and Convexity (3.2 mm) and a horizontal growth pattern.

Dental

Angle Class II Division 2 with retroclined and retrusive maxillary and mandibular incisors. An overbite of 100% and an overjet of 1 mm due to the retroclined maxillary incisors. The patient had a severely enlarged interincisal angle of 163.2°.

Treatment objectives

The treatment objectives were: to improve the deep bite and achieve a Class I molar and canine relationships with well aligned maxillary and mandibular arches; to improve the incisor inclination and interincisal angle; and to ensure good interdigitation with a functionally and aesthetically acceptable result.

Treatment options

There are different ways to treat an Angle Class II Division 2 malocclusion. When making use of functional appliances in Class II Division 2 malocclusions a working overjet first needs to be developed by proclining the maxillary incisors. The treatment options for this Class II Division 2 malocclusion included camouflage or surgical correction seeing as the patient was already past her growth spurt.

Camouflage treatment which makes use of fixed orthodontic treatment in conjunction with inter-arch elastics and/or extractions and/or skeletal anchorage depending on the severity of the case.

Surgical correction which includes a combination of fixed orthodontic treatment and orthognathic surgery. This treatment option can only be done after the age of 18 years.

The treatment option of choice in this case was to do camouflage by making use of fixed orthodontic appliances and inter-arch elastics with the addition of an acrylic splint in the mandible to facilitate in treating the severe deep bite.

Treatment Plan:

The following steps were followed for the chosen treatment plan:

1. Completed all necessary basic restorative dentistry, tooth 45 buccal caries was restored using composite.
2. Impressions were taken for the fabrication of an acrylic splint for the lower arch to extend from the 35 to the 45.
3. Pre-adjusted MBT (022 slot) fixed orthodontic brackets were placed and a standard wire progression followed in the maxilla. Buccal tubes were placed on the 46 and 36 in the mandible with inter-arch elastics to facilitate over-eruption of the mandibular first permanent molars to open the bite.
4. Every month the acrylic occlusal guard was adjusted to facilitate over-eruption of the posterior teeth.
5. After contact was achieved up until the second premolars the acrylic splint was removed and MBT pre-adjusted fixed orthodontic appliances were placed on all the remaining mandibular teeth.
6. Class II elastics were utilized to reduce the overjet and correct the Class II molar and canine relationships.
7. Teeth were torqued and the case finished on 0.019 x 0.025 natural arch stainless steel archwires.
8. Ensured good interdigitation of the permanent teeth in order for them to settle in the new Class I position.
9. Retention - Placed fixed retainers in the maxilla and mandible and a clear removable retainer in the maxilla.

Progress of Treatment

The MBT pre-adjusted orthodontic system was used to conduct the treatment (Figures 4 a-e). The fixed appliance system was placed only in the maxilla at the start of treatment with an acrylic splint (AS) in the mandible. A button was placed palatal of tooth 26 and buccal tubes were placed on the 36 and 46 to serve as attachments for the inter-arch elastics that facilitate the over eruption of the mandibular posterior teeth to open the bite. The inter-arch elastic of the 26 to the 36 extended from palatal of the 26 to buccal of the 36 to correct the unilateral posterior crossbite of the 26 with the 36 (Figure 4 e).

Once the first permanent molars were in contact the acrylic splint was trimmed to extend only from the 34 to the 44 and orthodontic brackets were placed on the 35 and 45 with inter-arch elastics to facilitate over eruption of the mandibular second premolars. Once the molars and second premolars were in contact the acrylic splint was removed and fixed appliances were placed on the rest of the mandibular teeth, see (Figures 5 a-e).

Once the maxillary and mandibular teeth were aligned and in stainless steel wires (Figures 6 a-c), Class II inter-arch elastics were used to reduce the overjet and correct the Class II molar and canine relationships, see Table 2. The Alignment in the maxilla and mandible was done using Nickel Titanium (NiTi) archwires and the case was

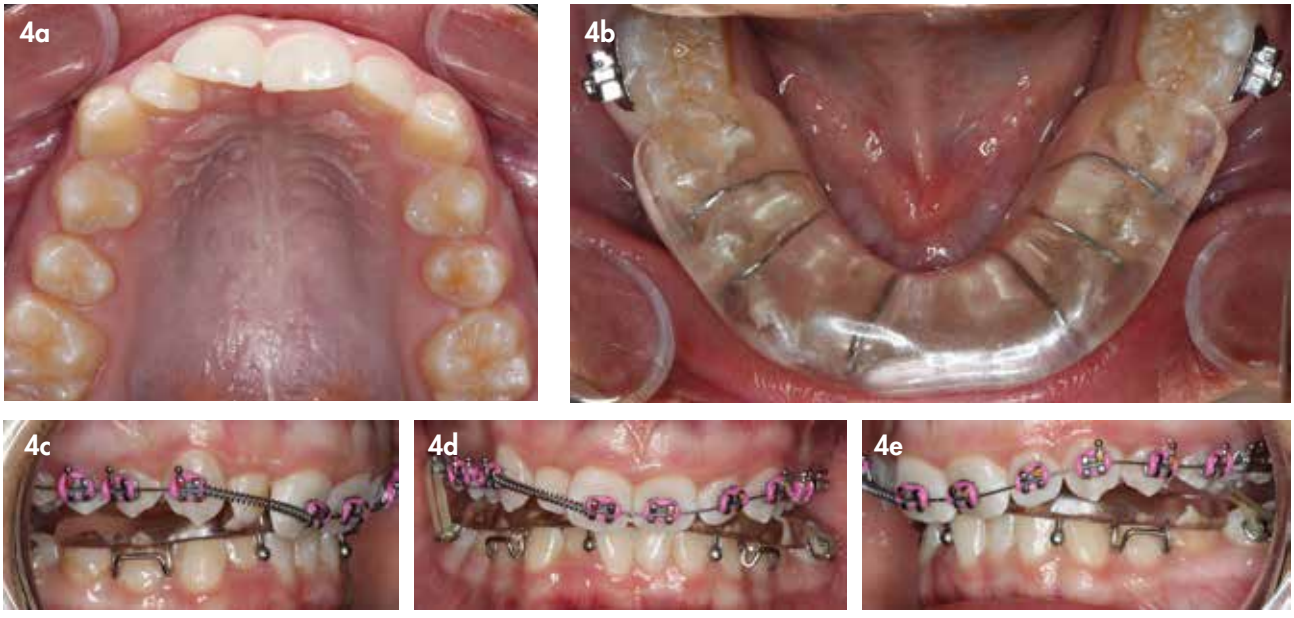

Figure 4 (a-e): Start of treatment with maxillary fixed appliances and mandibular acrylic splint.

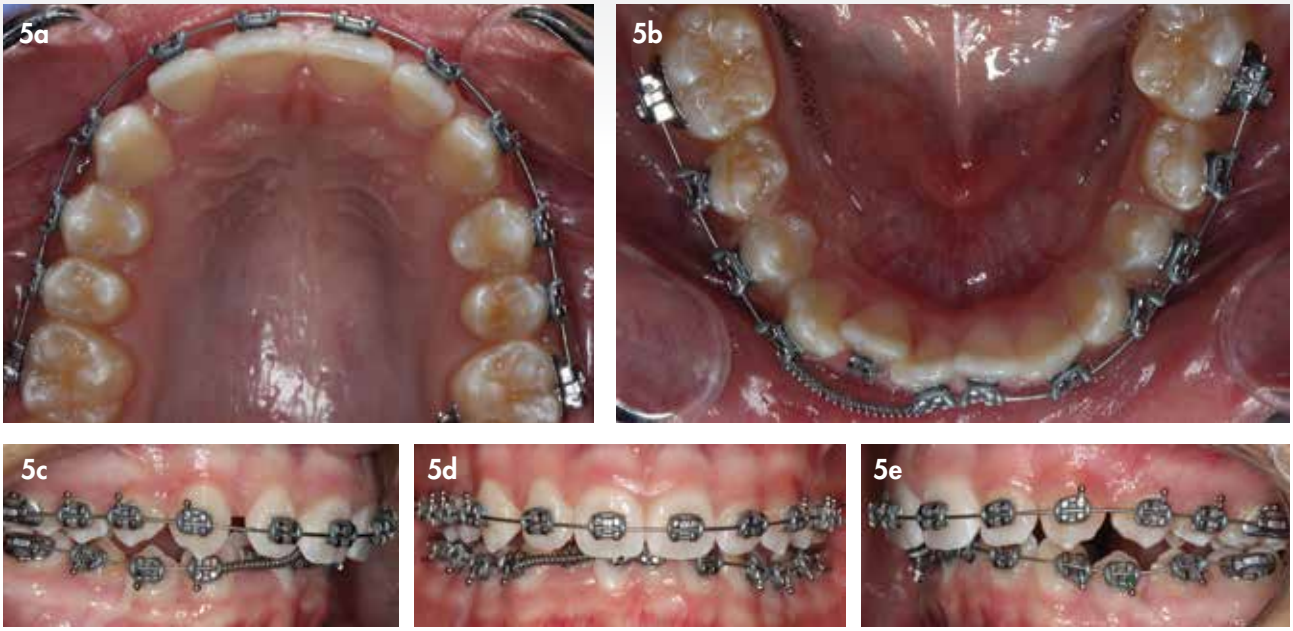

Figure 5 (a-e): Placement of mandibular fixed appliances.

finished on stainless steel (SS) wires. The following archwire sequence was used, see Table 2.

The final archwire for both arches was a 0.019 x 0.025 SS. The Inter-arch Class II elastics that were used during the treatment were stopped for the last 2 months of the treatment to evaluate if the patient had a stable Class I bite.

Table 2: Archwire and Inter-arch elastics sequence used for the treatment

Archwires		Inter-arch elastics	
Maxilla	**Mandible**	**Size and force**	**Direction**
0.014 NiTi	AS with buccal tubes on 36 and 46	4 Oz 4.8 mm	Teeth 16 to 46 (buccal) and 26 to 36 (through the bite)
0.016 NiTi	AS with buccal tubes on 36 and 46 and fixed brackets on 35 and 45	4 Oz 4.8 mm	Teeth 16,15 to 46,45 and 26,25 to 36,35
0.018 NiTi	0.014 NiTi	-	-
0.018 NiTi	0.016 NiTi	-	-
0.018 NiTi	0.018 NiTi	-	-
0.018 x 0.025 NiTi	0.018 x 0.025 NiTi	-	-
0.019 x 0.025 SS	0.019 x 0.025 SS	6 Oz 6.4 mm	Class II (maxillary canines to mandibular first permanent molars)

Figure 6 (a-c): Final archwire for both arches (019 x 025 SS).

Treatment outcome

The treatment resulted in well aligned arches with Class I molar and canine relationships (Figures 7 a-h). The deep bite improved significantly with the maxillary and mandibular midlines corresponding to the patient's midsagittal plane and the teeth were settled in the new occlusion. The unilateral posterior crossbite was resolved and the inclination and interincisal angle of the maxillary and mandibular incisors improved.

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

Figure 7 (a-h): Post-treatment photographs.

occurred from all the different views (Figures 8 and 9 a-e).

Frontal view: Vertical and transverse correction showing deep bite correction and correction of the unilateral posterior crossbite of tooth 26 with 36.

Lateral views: Improvement in the anteroposterior dimension with correction of the Class II molar and canine relationships to Class I as well as correction of the retroclined maxillary and mandibular incisor inclinations.

Maxillary and mandibular occlusal views: Well aligned arches without any residual spaces or rotations.

Cephalometric values

Table 3 below shows the values of the cephalometric analyses from the start to the completion of treatment and

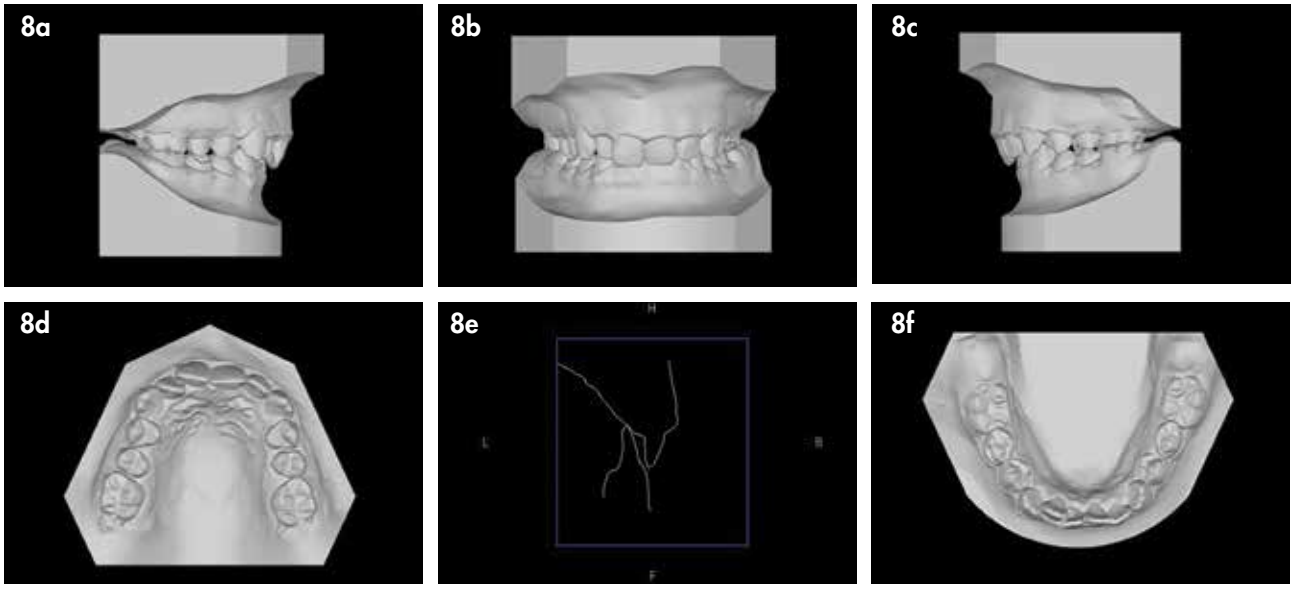

Figure 8 (a-f): Pre-treatment orthodontic study models.

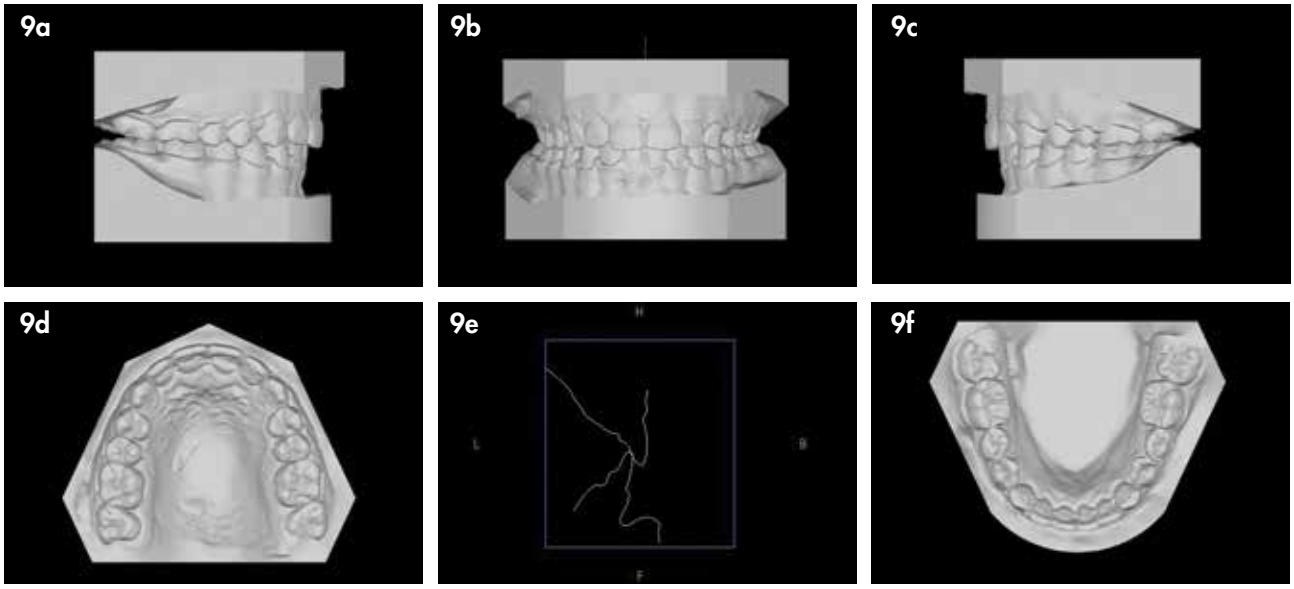

Figure 9 (a-e): Post-treatment orthodontic study models.

Figures 10 (a and b) shows the cephalograms before and after treatment.

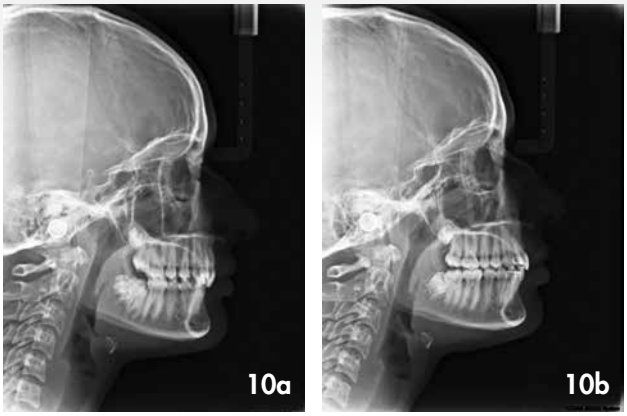

Figure 10 (a and b): Cephalograms before treatment (a) and after treatment (b).

Discussion

It is estimated that between 2% and 5% of a population have a Class II Division 2 malocclusion.[25,26,27] Class II Division 2 malocclusions are regarded as difficult to treat and they have the tendency to relapse after treatment.[28,29] Relapse tends to occur more frequently in adult cases than adolescents.[17]

A recurring deep overbite, crowded maxillary incisors and a steep axial maxillary incisor inclination is often seen after retention.[11] The maxillary incisor inclination should be corrected as close as possible to normal, keeping in mind that overcorrection is more prone to relapse.[30,31] An interincisal angle of less than 140 degrees after treatment is an important treatment objective to ensure long term stability.[32] The presence of a high lower lip line is frequently seen in Class II Division 2 malocclusion patients and is said to cause the steep maxillary incisor inclinations as well as the high frequency of relapse.[33,34,35] Removing the excessive overlap of the maxillary incisors by the lower lip is therefore an

Table 3: Cephalometric values before and after treatment

Cephalometric values	Normal	Pre - Treatment	Post treatment
SNA (°)	82.0	85.3	80.8
SNB (°)	80.9	79.8	76.6
ANB (°)	1.6	5.6	4.2
WITS (mm)	-1.0	3.8	2.3
Interincisal angle (°)	130.0	163.2	135.5
U1 – SN (°)	102.4	85.9	95.5
U1 – NA (mm)	4.3	-4.0	0.6
U1 – NA (°)	22.8	0.6	14.7
L1 – NB (mm)	4.0	-0.8	4.1
L1 – NB (°)	25.3	10.7	25.6
FMIA (L1 – FH) (°)	63.5	78.9	63.2
IMPA (L1 – MP) (°)	95.0	84.1	98.3
Lower lip to E-Plane (mm)	-2.0	-2.5	-0.9
Upper lip to E-plane (mm)	-3.3	-4.8	-4.2
Soft tissue convexity (°)	135.7	127.3	128.3
Convexity (A-NPo) (mm)	1.5	3.2	2.3
Nasolabial angle (°)	102.0	107.9	95.9
Facial angle (°)	87.2	91.4	90.6
Upper lip thickness at A-point (mm)	17.0	11.4	12.3
Upper lip thickness at Vermilion border (mm)	13.1	14.2	14.1

important objective when treating Class II Division 2 cases.[30]

It has been found that molar correction appeared to be stable after orthodontic treatment [36], but it's also important to remember that the amount and direction of mandibular growth after treatment has an influence on the stability of the overbite correction as well as the molar relationship after treatment of Class II Division 2 cases. [37,38] A minimum of 5 years is recommended to follow up treated Class II Division 2 cases since many skeletal, soft-tissue, and dental variables have shown significant changes from 2-5 years post-retention.[39]

Although there is some controversy surrounding the dentofacial characteristics of Class II Division 2 malocclusions,[40,41] some general agreement does exist and includes a normal maxillary prognathism in combination with a retrognathic mandible when the B-point is used as the reference.[42,43] Another characteristic feature is the retroclination of the maxillary incisors as well as a deep bite.[1] In severe cases vertical skeletal factors are evident. [44,45] When a high lower lip line is present with its associated resting pressure on the maxillary incisors, a retroclination of the maxillary incisors is commonly seen. [28,29]

Evidence from prospective studies show that in order to maximise favourable soft tissue and dentoalveolar changes during treatment, the facial growth pattern should be diagnosed early and the correction of the deep overbite done as soon as possible. [46] The increased overbite can be corrected with several techniques, but the success thereof will largely be determined by how well the interincisal angle is altered. [47] The interincisal angle can be corrected by proclining the maxillary or mandibular incisors or a combination of both. The mandibular incisor should occlude onto the cingulum of the maxillary incisor after the interincisal angle has been altered. [48] In order to ensure that the corrections to the interincisal angle and overbite is maintained in Class II Division 2 malocclusion cases, a long term retention protocol should be followed. [49]

Prospective international studies are required (either case control or randomized control trials) to provide stronger evidence on the treatment options and stability for Class II Division 2 malocclusions in children and adolescents.[39]

Conclusion

Class II Division 2 remains one of the most difficult malocclusions to treat.

A deep bite is a common feature in Class II Division 2 malocclusions and can be corrected using various techniques. In this case the use of a removable acrylic mandibular splint in combination with MBT fixed orthodontic appliances were used to correct the deep bite and Class II Division 2 malocclusion.

The success of this case was completely dependent on the compliance of the patient regarding wearing of the acrylic splint and inter-arch elastics to correct the deep bite, unilateral posterior crossbite and Class II molar and canine relationships.

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