Case Report

Skeletal Class II division 1 malocclusion treated with twin-block appliance

ABSTRACT

A 10-year-old female presented with a skeletal Class II relation with 7 mm of overjet, 40% overbite, and bilateral posterior lingual crossbite. Two-phase therapy was planned to correct Class II skeletal relation, overjet, overbite, and to achieve lip competency. Phase I therapy was done with twin-block appliance to advance the retrognathic mandible. Phase II therapy was accomplished with fixed appliance for arch coordination to correct minor displacement and to finalize occlusion. Posttreatment, skeletal Class I relation was achieved. Incisors' inclination was improved, and ideal overjet and overbite with bilateral class I molar relationship was achieved. As the mandible advanced, lip competency, facial convexity, and mentolabial sulcus improved.

Key words: Class I; Class II; overbite; overjet; twin-block appliance; two-phase therapy.

Introduction

Class II malocclusion presents in a wide variety of skeletal and dental configurations.[1] Although maxillary protrusion and mandibular retrognathism are both found to be possible causative factors, McNamara[2] reported that mandibular retrognathism is the most consistent diagnostic finding in skeletal Class II malocclusions. A number of treatment options are available for the correction of skeletal Class II malocclusions such as functional appliances, extraoral appliances, and surgical repositioning of the jaws. Functional appliance therapy has become an increasingly popular method of correcting Class II malocclusion during growth period. These appliances direct the pattern and direction of growth of the jaws by alteration of the forces produced by the neuromuscular complex. A restraining effect on the growth of maxilla and maxillary dentoalveolar complex is also seen along with the stimulation of mandibular growth and mandibular alveolar adaptation with functional appliance treatment.

A plethora of functional appliances such as the bionator,[3,4] the FR-2 of Fränkel,[5-7] the fixed and removable types of Herbst appliances,[8,9] and the Jasper Jumper[10] have gained widespread popularity for Class II correction in the last few years. Functional appliance system that has been successful during the last two decades is the twin-block appliance.[11,12] Twin-block appliance was developed by Clark of Fife, Scotland, for use in the correction of Class II malocclusions characterized in part by mandibular skeletal retrusion.[13,14] The popularity of twin block is attributed to its high patient adaptability and ability to produce rapid treatment changes.[15] A major advantage of twin-block appliance is its relatively smaller size compared to other functional appliances. The appliance consists of maxillary and mandibular acrylic plates with bite blocks, which interlock at a 70° angle on closure while posturing the mandible forward.[16,17] The fact that it comes in two parts rather than as a mono bloc is said to enhance patient compliance and minimize speech disturbance.[18]

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This case report demonstrates treatment of a patient with Class II Division I malocclusion using two-phase therapy. The first phase of treatment was accomplished with twin-block appliance and phase II with fixed appliance.

Case Report

A 10-year-old female reported with a chief complaint of "front teeth sticking out." No relevant medical history was reported. Extraoral examination [Figure 1] revealed a mesocephalic head shape, mesoprosopic face type, retrognathic mandible, convex profile, and deep mentolabial sulcus. No abnormality was detected in the temporomandibular joint. Intraoral examination revealed a Class II molar relationship, 40% overbite, 7 mm of overjet, and bilateral posterior lingual crossbite. The patient was in the mixed dentition stage. Both arches were grossly symmetrical. Upper midline was shifted by 1.5 mm to the right side in relation to facial midline [Figure 2]. Panoramic radiograph showed presence of all 28 teeth with no evidence of bone loss. The lateral cephalometric radiograph revealed ANB of 5° and Wits appraisal of 2.5 mm, indicative of a Class II skeletal pattern. An SNB angle of 78° indicated that the mandible was retrognathic [Figure 3]. The skeletal pattern was horizontal as evidenced by the SN-MP angle of 20°. Maxillary incisors were proclined with U1-NA-7 mm/30° and mandibular incisors were upright over the basal bone with L1-NB-4.5 mm/23° [Table 1]. Hand-wrist radiograph suggested that 65%–85% of growth was left according to Bjork, Grave, and Brown method. Cervical vertebrae indicated acceleration period of growth.

Figure 1: Pretreatment facial photographs

Treatment objectives

The objectives of Phase I therapy were to advance the retrognathic mandible to correct skeletal Class II relation and to reduce convexity of the face. The objectives of Phase II therapy were to maintain space for erupting permanent teeth, reduce upper incisor proclination, correct lingual posterior crossbite, and settling the occlusion.

Treatment plan

The main criteria in determining treatment plan were the skeletal Class II relation with retrognathic mandible and overjet. Two-phase therapy was planned. Phase I therapy was planned with twin-block appliance to advance the retrognathic mandible to correct skeletal Class II relation. Phase II therapy was planned with fixed appliance for arch coordination to correct minor displacement and to detailing the occlusion.

Treatment progress

Phase I: Growth modification therapy

Phase I treatment involved the use of twin-block appliance to advance mandible, to reduce overjet, and to achieve Class I skeletal relationship [Figure 4]. The design of the upper component of twin-block appliance included an acrylic base plate which covered the palate and occlusal surfaces of the first molars and second premolars. There was an inclined plane at the end of the mesial end of acrylic block. A labial bow was used for anterior retention of the appliance. A midline screw was also included. The jack screw was activated at a rate of 0.5 mm/week for 8 weeks to achieve a maxillary expansion of 4 mm. The lower component consisted

Figure 2: Pretreatment intraoral photographs

of a lingual acrylic base plate covering the edge of the lower incisors. Both blocks had Adams clasps on the first molars and first premolars to provide posterior retention. Use of twin-block appliance was discontinued after 12 months of treatment [Figure 5]. An upper twin-block retainer providing a positive incisal stop was delivered to be worn full time for 3 months. This phase was followed by fixed appliance to close spaces and for finishing and detailing.

Table 1: Cephalometric findings

Variable	Standard	Pretreatment	Posttreatment
Skeletal			
SNA (°)	82±2	83	82
SNB (°)	80±2	78	81
ANB (°)	2	5	1
GO GN-SN (°)	32	20	25
Wits appraisal	0	2.5	0
Dental			
U1-SN (°)	102±2	110	105
U1-NA (mm/°)	4/22	7/30	4.5/26
L1-NB (mm/°)	4/25	4/23	5.5/28.5
IMPA (°)	92±5	95	100.5
Soft tissue			
Nasolabial angle	90-110 mm	94°	96°
Upper lip - S line (mm)	0	2	0
Lower lip - S line (mm)	0	2	0

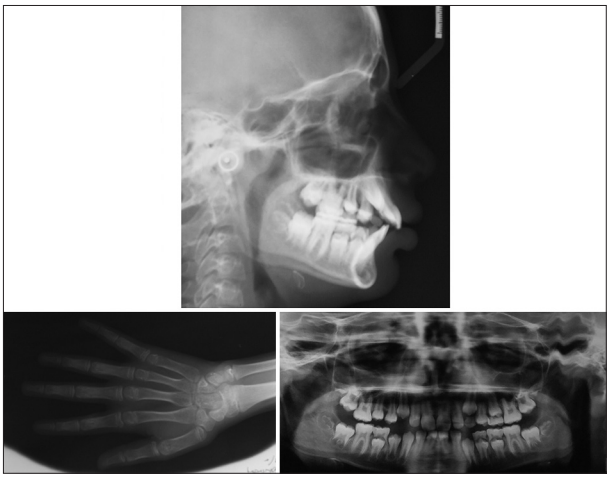

Figure 3: Pretreatment orthopantomograph, lateral cephalogram, and hand-wrist radiograph

Phase II: Fixed appliance

MBT appliance (Ormco, Glendora, CA, USA) 0.022 × 0.028″ slot was used. An expanded transpalatal arch was placed in the upper arch and constricted lingual arch in the lower arch to correct lingual crossbite and to enhance anchorage. Alignment and leveling was accomplished with the following sequence of archwires: (a) 0.016″ heat-activated nickel-titanium archwires (b) 0.018″ stainless steel archwires, and (c) 0.017 × 0.025″ stainless steel archwires [Figure 6]. The archwires were cinched distal to molar to avoid maxillary and mandibular incisor proclination. After aligning and leveling, both arches were coordinated on 0.019 × 0.025″ stainless steel archwires. Finishing was done by 0.021 × 0.025″ titanium molybdenum alloy archwires. The settling was accomplished by 0.021 × 0.025″ braided stainless steel archwires with vertical settling triangular elastics. Case was debonded, and upper- and lower-bonded lingual retainers were given. The active treatment ended in 26 months. The patient is being recalled for every 6 months for follow-up.

Treatment result

The change in the patient's facial esthetics was the most impressive part of her treatment. With twin-block therapy, 3 mm advancement of the mandible was achieved which fixed skeletal Class II relation into skeletal Class I relation. Her lip competency [Figure 7] and facial convexity were improved. Bilateral Class I molar relationship was achieved. Dental midline was corrected in relation to facial midline. Bilateral posterior lingual crossbite was corrected and ideal overjet and overbite was achieved. Posttreatment, intraoral photographs and

Figure 4: Phase I – twin-block appliance

Figure 5: Completion of twin-block appliance

Figure 6: Phase II - fixed appliance therapy

Figure 7: Posttreatment facial photographs

lateral cephalogram [Figures 7-9] showed that the maxillary and mandibular incisors were inclined appropriately. The soft tissue chin thickness improved as the lip strain was reduced. The panoramic radiograph [Figure 9] showed adequate root parallelism in both the upper and lower arches.

Discussion

The main objective of therapy with functional appliances is to induce supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage. The existence of a pubertal peak in mandibular growth has been described previously in classical cephalometric studies.[19-24] The peak growth velocity would be expected around age 12 years in girls and age 14 years in boys.[25] Petrovic *et al*. revealed that the therapeutic effectiveness of various functional appliances is most favorable when these appliances are used during the pubertal growth spurt.[26,27] However, it seems desirable to stimulate mandibular growth as much as possible in young patients with retrognathic mandibles with the objective of avoiding more complex treatment after maturity. There were several reasons for choosing to begin treatment early. First, McNamara *et al*.[28,29] have shown that the earlier treatment starts, the more skeletal correction is achieved. Second, the nature of twin-block appliance design makes it more suitable for treatment when there are solid deciduous molars available for clasping purposes. Third, younger patients generally adapt more readily to wearing removable appliances and are less likely to have speech difficulties than their teenage counterparts. Thus, it was considered preferable to intervene early with twin-block

Figure 8: Posttreatment intraoral photographs

treatment to decrease the skeletal dysplasia before the patient reached her teen years.

The positive esthetic outcome at the end of two-phase treatment in our case can be attributed to skeletal and dentoalveolar changes produced by twin-block appliance. Posttreatment, the patient experienced an increase in SNB angle of 3°, from 78° to 81°. This was most likely a result of increased mandibular growth. In contrast, there was 1° reduction in SNA angle from 83° to 82° which can be attributed to the "headgear effect" produced by the twin-block appliance.[30] Mills and McCulloch reported similar changes in SNA and SNB measurements in their study.[18] Functional appliances have been criticized for their tendency to procline the lower incisors and retract the upper incisors.[31,32] Mandibular incisor proclination was increased by 5.5° in this case. Various studies have reported lower incisor proclination of 2.8° to 7.9°, after twin-block appliance therapy.[18,33,34] This proclination is probably due to the anchorage loss in response to keeping the mandible in a protrusive position.[1,33] Lower incisor proclination aids in achieving the initial overjet correction but reduces the scope for a skeletal component in the overjet correction. Moreover, proclination of lower incisors is proven to be unstable over the long term and is liable to relapse.[35] Therefore, an additional stage of treatment may be required to upright the lower incisors. Maxillary incisor proclination was reduced from 110° to 105° in this case. This lingual tipping may be due to the labial bow in the twin-block appliance[36] or due to contact of the lip musculature during treatment.[33] Overjet was reduced from 7.5 mm to 1.5 mm in this case which was attributed to the skeletal and dental changes.

A second phase of treatment, using fixed appliance therapy, is necessary to correct other occlusal irregularities and to obtain finer detailing of occlusion. Use of a twin-block appliance in the first phase of treatment reduces the expected duration of fixed appliance therapy in the second phase of treatment; it also has the advantage of avoiding fracture of proclined maxillary incisors. Patients' facial esthetics will be greatly improved within a reasonably short period of time without having to delay treatment until the early permanent dentition. In addition, the risk of external apical root resorption, which has been reported to be higher in one-phase than in two-phase treatments, has been reduced.[37,38] Furthermore, the need for a two-unit extraction in the upper arch as part of the fixed appliance therapy or orthognathic surgery has been eliminated.

Figure 9: Posttreatment orthopantomograph and lateral cephalogram

Conclusion

This case was successfully treated with two-phase therapy. Growth modulation was achieved with twin-block appliance in phase I and occlusion was finalized with fixed appliance in phase II. The mandible was advanced by 3 mm [Figure 10]. Twin-block appliance therapy results in both skeletal and dentoalveolar adaptations. Skeletal Class I relation was achieved, facial convexity decreased, and competency of lips achieved. The patient presented a positive smile arc with a pleasing smile at the end of the treatment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have

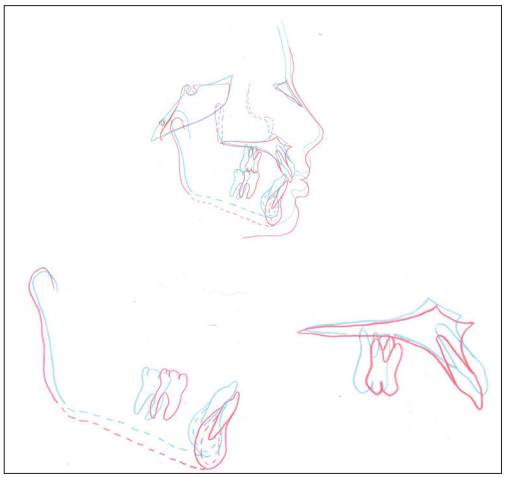

Figure 10: Superimposition

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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