Early treatment outcomes of class II malocclusion with twin-block facial profile and cephalometric changes

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ABSTRACT

Esthetic improvement is highly valued by patients seeking orthodontic treatment. Subjects with a class II malocclusion are a good example of patients who seek treatment primarily for esthetic improvement. A young growing child with convex profile due to a small, retropositioned mandible, normal midface and lower lip trap is more suitable for functional appliance treatment. Functional appliances encourage adaptive skeletal growth by maintaining the mandible in a corrected forward position for a sufficient period of time to allow adaptive skeletal changes to occur in response to a functional stimulus. The aim of this article is to describe two cases of class II malocclusion in late mixed dentition period treated with twin-block. The cephalometric and facial profile changes have been discussed.

Keywords: Class II malocclusion, functional appliance, twin-block.

INTRODUCTION

‘The functional matrix theory of Moss supports the premise that function modifies anatomy’. The form and function concept steadfastly remains the basic concept of functional therapy. The objective is to promote harmonious facial growth by changing the functional muscle environment around the developing dentition.¹

A wide range of functional/orthopedic appliances is available for the correction of class II skeletal and occlusal disharmonies (e.g. Bionator, FR-2 of Fränkel, fixed, and removable Herbst appliances). Among these, the twin-block originally developed by William J. Clark of Fife, Scotland, has gained increasing popularity during the last decade. Twin-block appliance induces supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage.

The appliance consists of maxillary and mandibular acrylic plates with bite blocks that posture the mandible forward on closure.² Unlike one-piece functional appliances, twin-block has two separate, unattached upper and lower bite block components—actually two appliances which work together as one. Functional appliance has definite advantages in the treatment of patients with severe overjets or limited ability to posture the mandible forward.³

This article describes two cases of class II malocclusion treated successfully with twin-block.

CASE 1

An 11-year-old boy in the late mixed dentition period with an Angle’s class II division 1 malocclusion reported to the Department of Pedodontics, Kothiwal Dental College, Moradabad, with the chief complaint of protruding maxillary teeth and unesthetic appearance (Figures 1 and 2). On examination, it was found that the patient had developing Angle’s class II malocclusion. The mandible was retrognathic and an overjet of 13 mm was recorded. The maxillary anterior dentition was proclined. The overbite was deep and complete. The buccal segments showed a full unit distal occlusion. A construction wax bite with 6 mm mandibular protrusion and 2 mm inter-incisal separation was recorded. A twin-block appliance was fabricated. Therapeutic trimming of the posterior bite blocks was done to facilitate the eruption of mandibular molars during follow-up visits. After 5 months, reactivation of the appliance was done with mandibular advancement of 3 mm.

Reactivation of the appliance in a sagittal direction is often required during treatment. Patients may not tolerate the

Figure 1 Pre-treatment extra-oral profile: (A) front view and (B) lateral view. Post-treatment extra-oral profile: (C) front view and (D) lateral view.

required initial mandibular advancement. In cases with larger overjets, sequential additions to the acrylic bite blocks are usually necessary to achieve the recommended edge-to-edge incisor relationship, while maintaining patient comfort and compliance. Clark recommended laboratory additions of cold-cured acrylic to the mesially inclined plane of the upper bite blocks.⁴ As the appliance was discontinued for a short period to let the teeth erupt for fabrication of the wire component, the reactivation of the appliance was not a problem.

The anteroposterior correction was achieved after 10 months. The twin-block appliance was replaced with a maxillary Hawley's appliance with an anterior inclined plane to support the corrected occlusion and an active labial bow. Support and retention phase continued till the buccal segments settled into a stable occlusion with good cuspal interdigitation. The results showed reduced marked reduction in overjet and overbite, and improved facial profile. Pre- and post-treatment cephalometric appraisals revealed that sagittal correction was achieved by an increase in the Sella-Nasion B-point (SNB) angle. The maxillary incisors had retroclined with the interincisal angulation approaching toward normal (Table 1).

CASE 2

A 10-year-old girl in the late mixed dentition period reported to the Department of Pedodontics, Kothiwal Dental College, Moradabad, with the chief complaint of protruding maxillary teeth and unesthetic appearance (Figures 3 and 4). On examination, it was found that the patient had developing Angle's class II malocclusion. The mandible was retrognathic and an overjet of 6 mm was recorded. The maxillary anterior dentition was proclined. The overbite was deep and complete. The buccal segments showed a full unit distal occlusion. A construction wax bite with 4 mm mandibular protrusion and 2 mm interincisal separation was recorded. A twin-block appliance was fabricated. The appliance was fitted and the patient instructed to wear it at all times except while brushing, swimming, and during contact sports. The patient was reviewed every 8 weeks. Therapeutic trimming of the posterior bite blocks was done to facilitate eruption of the mandibular molars during follow-up visits. The anteroposterior correction was achieved after 7 months. The twin-block appliance was replaced with Hawley's appliance with an anterior inclined plane to support the corrected occlusion

Figure 2 (A,B) Pre- and post-treatment intra-oral view. (C) Pre-treatment lateral cephalogram showing retruded mandible, increased overjet, and overbite. (D) Post-treatment lateral cephalogram showing corrected mandibular position, overjet, and overbite.

Table 1 Pre- and post-treatment cephalometric measurements

Cephalometric measurements	Normal values	Pre-operative	Postoperative
SNA (Sella–Nasion A-point)	82°	86°	84°
SNB (Sella–Nasion B-point)	80°	75°	77°
ANB	2°	11°	7°
Mandibular plane angle (G_o-G_N to Sella–Nasion)	17–28°	22°	27°
Maxillary length (Condylon point A)	100 mm (males)	90.5 mm	88 mm
Mandibular length (Condylon point B)	130 mm (males)	101 mm	103 mm
Difference between maxillary and mandibular length	30 (males)	9.5 mm	15 mm
Y-axis (Nasion–Sella–Gnathion)	53–66°	55.5°	64°
Wit appraisal	1 mm	9.5 mm	6 mm
Upper incisor to N–A	22°	33°	17°
Upper incisor to N–A (linear)	4 mm	7 mm	1.5 mm
Lower incisor to N–B	25°	31°	31°
Lower incisor to N–B (linear)	4 mm	3 mm	4 mm
Interincisal angle	130°	112°	126°
Nasolabial angle	110°	87°	102°

ANB=angle formed by supramentale-nasion-subspinale.

Figure 3 Pre-treatment extra-oral profile: (A) front view, (B) lateral view. Post-treatment extra-oral profile: (A) front view, (B) lateral view.

and an active labial bow. Support and retention were continued till the buccal segments settled into a stable occlusion with good cuspal interdigitation.

The results showed well-aligned arches with the overjet and overbite reduced successfully, and improved facial profile. Pre- and post-treatment cephalometric appraisals reveal that sagittal correction was achieved by an increase in the SNB angle. The maxillary incisors have retroclined with the interincisal angulation approaching toward normal (Table 2).

DISCUSSION

Malocclusion is a deviation from rarely attained ideal arrangement among teeth (normal occlusion) that does not necessarily cause a functional problem. Class II division 1 malocclusion is characterized by the mandibular dentition 'distal' to the maxillary dentition; the malrelation may be due to a basic osseous dysplasia or due to forward movement of the maxillary dental arch and alveolar processes or combination of skeletal and dental factors.⁵ The functional

appliances are used in the hope of correcting class II skeletal malocclusion by enhancing mandibular growth.

A young growing child with convex profile due to a small, repositioned mandible, normal midface, and lower lip trap is more suitable for functional appliance treatment.⁶ A functional appliance displaces the lower jaw downwards and forwards and increases the intermaxillary space in the anteroposterior and vertical dimensions. Repositioning the mandible stimulates a proprioceptive response in the muscles of mastication.¹

The twin-block developed by Clark has proved to be a popular and clinically successful appliance.⁷ The appliance consists of two separate, upper and lower, removable plates that makes the twin-block appliance different in comparison with other removable functional appliances, which are basically monoblocks. Patients would have more freedom in their mandibular movements.⁸ Due to its simple design and ease of use, it can be worn 24 hours a day and takes full advantage of all the functional forces applied to the dentition, including those of mastication.⁹

The appliance is versatile enough to treat the following malocclusions: class II division 1, class II division 2, class I open bite, class I closed bite, class III, anteroposterior

Figure 4 (A,B) Pre- and post-treatment intra-oral view. (C) Pre-treatment lateral cephalogram showing retruded mandible, increased overjet, and overbite. (D) Post-treatment lateral cephalogram showing corrected mandibular position, overjet, and overbite.

Table 2 Pre- and post-treatment cephalometric measurements

<i>Cephalometric measurements</i>	<i>Normal values</i>	<i>Pre-treatment</i>	<i>Post-treatment</i>
SNA (Sella–Nasion A-point)	82°	79°	80°
SNB (Sella–Nasion B-point)	80°	75°	78°
ANB	2°	4°	2°
Mandibular plane angle (G_o-G_N to Sella–Nasion)	17–28°	23°	24°
Maxillary length (Condylon point A)	94 mm (females)	93 mm	93 mm
Mandibular length (Condylon point B)	120 mm (females)	104 mm	109 mm
Difference between maxillary and mandibular length	26 mm (females)	11 mm	16 mm
Y-axis (Nasion–Sella–Gnathion)	53–66°	50°	51°
Wit appraisal	1 mm	4 mm	2 mm
Upper incisor to N–A	22°	57°	26.5°
Upper incisor to N–A (linear)	4 mm	9 mm	5.5 mm
Lower incisor to N–B	25°	23°	23°
Lower incisor to N–B (linear)	4 mm	2 mm	2 mm
Interincisal angle	130°	106°	129°
Nasolabial angle	110°	100°	105°

ANB=angle formed by supramentale-nasion-subspinale.

arch length discrepancies. Large SN–MP angle, large gonial angle, large incisor mandibular plane angle (IMPA), unfavorable Jaraback's ratio and short vertical ramus all point to a vertical growth pattern which are unfavorable for functional appliance treatment with twin-block alone.⁶

The main objective of the therapy with twin-block is to induce supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage and restriction of the maxillary growth. The distraction of the mandibular condyles out of the glenoid fossa reduces the pressure on the actively growing condylar cartilage and alters the muscle tension on the condyles, increasing the amount of endochondral growth more than would normally occur. The improvement of sagittal skeletal relationship can be measured on several cephalometric parameters such as reduction of facial convexity, increasing in effective length of the mandible, and reduction of angle formed by supramentale-nasion-subspinale (ANB) angle.⁶

It can be used in both early and late mixed dentition period. Use of the appliance in the early mixed dentition period has the benefit of improvement in the facial appearance which helps to increase the self-esteem of the child. Large overjet and tooth display render profiles less attractive; correction of this visible feature of class II malocclusion is of value and could be considered a benefit of early orthodontic treatment for class II malocclusion.¹⁰

Early correction of large overjets in severe skeletal class II discrepancies may be indicated to reduce the risk of trauma to prominent incisors.² There are definite disadvantages to the two-phase treatment approach including increased burdens for the patient in terms of attendance, costs, and length of treatment.

The changes produced in our cases can be appreciated through the cephalometric values (Tables 1 and 2). There is significant favorable change in the position and lower face height. The dental changes include reduction of the upper incisor angulation and increase in the incisor mandibular plane from 5° to 10°. Twin-block appliance reduces the overjet by a combination of dentoalveolar and skeletal changes. Frontal teeth tip significantly in the upper dental arch and less in the lower.⁹ As general consideration, twin-block therapy produces an efficient reduction in the overjet and a remarkable correction in the molar relation. Both favorable occlusal changes are due mainly to the skeletal modifications occurring almost exclusively in the mandible.²

Dentofacial orthopedics represents a positive approach to the treatment of craniofacial imbalance by addressing the underlying cause of malocclusion, in an effort to maximize the natural potential for corrective growth.

Research studies have questioned the efficacy of functional appliance treatment, yet their clinical performance has

been the reason for their continued and expanding popularity in treating developing class II malocclusions.⁶ It appears more logical to prevent an abnormality from occurring rather than to wait until it has become fully developed. The case selection, appliance design, rigorous follow-up, and favorable growth are key factors that determine the success of functional appliance therapy.⁶

Author's perspective

Although, the twin-block therapy can be started during early or late mixed dentition phase, initiation at an early phase gives the additional advantage of improvement in the self-esteem and throws a positive impact on the psychology of the child. Thus, it would be of greater advantage to the dentist as well as to the patient to start the therapy at an early stage and enhance the self-confidence of the child.

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