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Treatment of a severe class II division 1 malocclusion with twin-block appliance

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Abstract
This case report describes the management of a female with a severe Class II skeletal discrepancy, Class II molar and canine relationship bilaterally, a large overjet and an impinging overbite. As the patient was in CVMI stage 4, it was planned to make use of remaining growth for correction of skeletal discrepancy and so the treatment was initiated with a removable twin block. This promoted the growth of the mandible, restrained maxilla in anteroposterior direction which in combination with the fixed appliances for alignment and leveling of the dentition improved the convex soft tissue profile. Thus severe skeletal Class II discrepancy was successfully managed with the combination of functional correction along with comprehensive fixed mechanotherapy without any extraction resulting in acceptable soft tissue changes.

Keywords: Class II division 1 malocclusion, skeletal class II malocclusion, twin-block appliance

Introduction

Case Summary

A 12-year-old female, presented with the chief complaint of forwardly placed upper front teeth. She had a Class II skeletal pattern with retrognathic mandible and Angle's Class II division 1 malocclusion with an overjet of 14 mm. A removable twin-block appliance with an expansion screw was used to reduce the amount of sagittal skeletal discrepancy. After the functional phase, nonextraction treatment was carried out with a preadjusted edgewise appliance-MBT prescription 0.022" slot. The duration of the treatment was 24 months. Maxillary circumferential retainer and mandibular bonded retainer from canine-to-canine were used for retention.

Clinical examination

Extraoral features: Profile-convex; clinical Frankfort mandibular angle-average; lip competence-incompetent; upper incisor exposur-8 mm; nasolabial angle-obtuse; mentolabial sulcus-deep; size of nose and chin-normal Class II skeletal pattern with 7° ANB, Wits appraisal of 9 mm, and a unit length difference of 17 mm, orthognathic maxilla, retrognathic mandible, reduced mandibular corpus length, N-Se mandibular base-20:18.5, maxillary base: Mandibular base-2:2.8, normal lower facial height, average growth pattern, proclined maxillary incisors and mandibular incisors, protrusive lower lip, and an obtuse nasolabial angle were identified.

Intraoral features-Soft tissues: Frenal attachments-normal; oral hygiene: Fair Crowding/spacing-maxillary arch: Crowding of 3 mm; mandibular arch: Crowding of 7 mm; retrognathic mandible, a horizontal growth pattern, mesomorphic facial form, Angle's Class II division 1 malocclusion, narrow maxillary arch, crowding in both the arches, an increased overjet of 14 mm, and deep overbite of 6 mm were observed.

	Occlusal features [Figure 1
Incisor relationship	Class II
Overjet (mm)	14
Overbite	6
Centerlines	Maxillary midline shifted to the left by 2 mm
	Mandibular midline shifted to the left by 4 mm
Left buccal segment relationship	Class II
Right buccal segment relationship	Class II
Crossbites	None
Displacements	Labial displacement of 33
Other features	Narrow maxillary arch, transpalatal width‑31 mm

Table 1: Rakosi Freiburg's analysis

(OPG) and lateral cephalogram.		Skeletal Class II malocclusion with orthognathic maxilla,	
Variable	**Pretreatment**	**Postfunctional**	**Posttreatment**
Sagittal skeletal relationship			
SNA (°)	82	82	82
SNB (°)	75	77	76
ANB (°)	7	5	6
Wits appraisal (mm)	9	4	4.5
Dental base relationship			
Upper incisor to NA (degree/mm)	33/9	23/7	23/4
Lower incisor to NB (degree/mm)	25/5	30/8	33/10
Upper incisor to SN plane (°)	111	107	102
Lower IMPA (°)	99	101	106
Dental relationship			
Inter‑incisal angle (°)	115	118	119
Lower incisor to APo line (mm)	0	3	4
Over bite (mm)	6	5	3
Overjet (mm)	14	8	3
Vertical skeletal relationships			
Maxillary ‑ mandibular planes angle (°)	27°	28°	27°
SN plane ‑ mandibular plane (°)	32	33	34
Upper anterior face height (mm)	49	50	51
Lower anterior face height (mm)	62	69	73
Jarabak ratio (%)	65	66	67
Maxillary length (mm)	85	90	91
Mandibular length ‑ effective (McNamara) (mm)	102	111	112
Soft tissues			
Lower lip to Ricketts E plane (mm)	+4	+4	+6
Nasolabial angle (°)	118	110	122
IMPA: Incisor to mandibular plane angle			

Problem list

1. Convex profile with retrognathic mandible
2. Incompetent lips and lip trap
3. Crowding in both the arches
4. Class II molar and canine relationship
5. Increased overjet
6. Midline shifted to the left by 2 mm in the upper arch
7. Midline shifted to the left by 4 mm in the lower arch
8. Deep overbite.

Aims and objectives of treatment

1. Reduction of sagittal skeletal discrepancy
2. Achieving lip competency
3. Expansion of the narrow maxillary arch
4. Correction of crowding
5. Correction of increased overjet
6. Correction of Class II molar and canine relationship
7. Correction of the shift in midlines
8. Correction of deep overbite.

Treatment plan

The treatment plan was growth modification therapy with a removable functional appliance, followed by nonextraction treatment with a fixed appliance.

Appliances

1. Removable twin‑block appliance with an expansion screw and lower incisal capping [Figure 4]
2. A preadjusted edgewise appliance-MBT prescription 0.022" slot.

Proposed retention strategy: Maxillary circumferential retainer and mandibular fixed retainer.

Additional notes on treatment plan

The prognosis for growth modification therapy was good in this case as the VTO (Visual Treatment Objective) was positive, the saddle angle was normal and mandibular retrognathism was due to the reduced corpus length. The patient had not attained menarche. The cervical vertebral maturation status showed the deceleration phase of growth CS4.

Randomized controlled trials have shown that favorable mandibular growth often occurs in adolescents and early treatment is not routinely superior in guiding growth. The best timing of treatment with twin‑block appliance is at or slightly after the onset of peak in mandibular growth. A systematic review, randomized, and prospective controlled trials have proved that the twin‑block appliance is more efficient than the other removable functional appliances when used around the pubertal growth spurt.

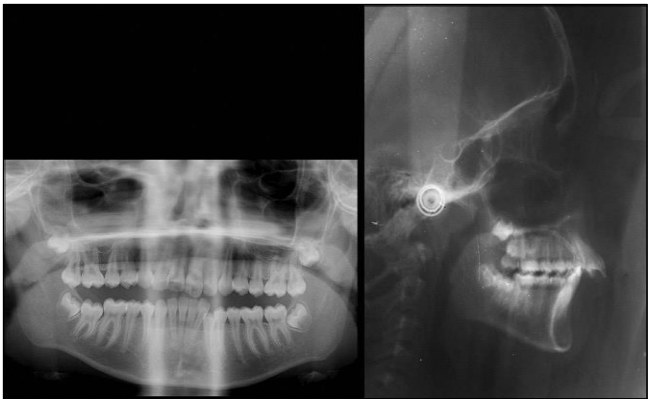

Fig 1: Pretreatment radiographs

Fig 2: Mid-treatment photographs: Twin-block appliance

A fixed appliance in conjunction with a fixed/removable functional appliance could have been used in this case. It is preferable to place a lower rigid wire with labial root torque in the anterior region to prevent incisor proclination while using functional appliances with a fixed appliance. Alignment and leveling in the lower arch would have delayed the placement of the functional appliance. Therefore, a removable twin‑block appliance with an expansion screw and lower incisal capping was planned before the fixed appliance phase.

After the growth modification therapy, nonextraction treatment was planned with the preadjusted edgewise appliance, considering her increased nasolabial angle and the need for minimal retraction of the maxillary incisors.

Postfunctional assessment [Table 2, Figures 5 and 6]

Crowding/spacin

- Maxillary arch spacing: 2.5 mm
- Mandibular arch crowding: 7 mm.

Incisor relationship	Class II
Overjet (mm)	7
Overbite (mm)	3
Centerlines	Maxillary midline shifted to the left by 2 mm
	Mandibular midline shifted to the left by 4 mm
Left buccal segment	Super Class I
Relationship	
Right buccal	Super Class I
segment relationship	
Crossbites	None
Displacements	32 lingually displaced, 33 buccally displaced
Other features	Transpalatal width‑36 mm, increased by 5 mm

Postfunctional cephalometric interpretation [Figure 7]

1. The sagittal skeletal discrepancy reduced. SNB angle increased by 2°; the Wit's value decreased by 4.5 mm
2. The effective mandibular length increased by 9 mm
3. The maxillary growth was not restricted
4. The maxillary incisors retroclined by 4°
5. The mandibular incisors proclined by 3°
6. The mandibular and basal plane angles increased by 1° each
7. The lower anterior facial height increased in relation to the upper face height
8. The growth was expressed more horizontally as the Jarabak ratio increased by 1%.
9. The effective mandibular length increased by 9 mm
10. The maxillary growth was not restricted
11. The maxillary incisors retroclined by 4°
12. The mandibular incisors proclined by 3°
13. The mandibular and basal plane angles increased by 1° each
14. The lower anterior facial height increased in relation to the upper face height

The growth was expressed more horizontally as the Jarabak ratio increased by 1%. Nonextraction treatment with MBT appliance was started. The sequence of wires used was 0.016" NiTi archwire, 0.018" AJW archwires, and 0.019"‑0.025" NiTi and stainless steel archwires. All these stages were documented with intraoral photographs [Figure 7].

Fig 3: Postfunctional photographs

Fig 4: Postfunctional study models

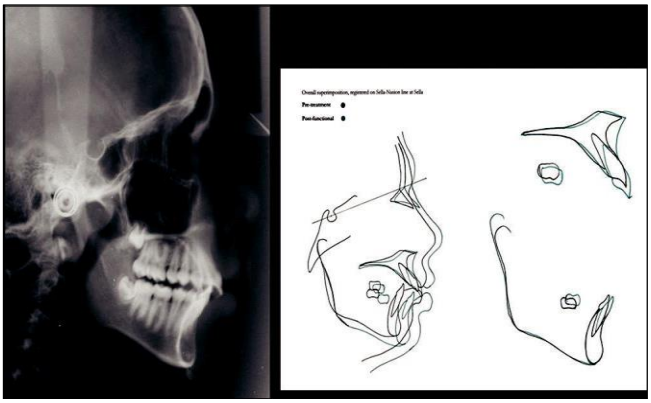

Fig 5: Postfunctional cephalogram with superimposition

Fig 6: 0.019"-0.025" stainless steel archwires

Prefinishing photographs, study casts, and OPG and lateral cephalograms were taken and assessed with the prefinishing checklist for proper finishing of the occlusion.

Section: Posttreatment assessment

Occlusal features	
Incisor relationship	Class I
Overjet (mm)	3 mm
Overbite	3 mm
Centerlines	Coinciding
Left buccal segment relationship	Class I
Right buccal segment relationship	Class I
Crossbites	None
Displacements	None

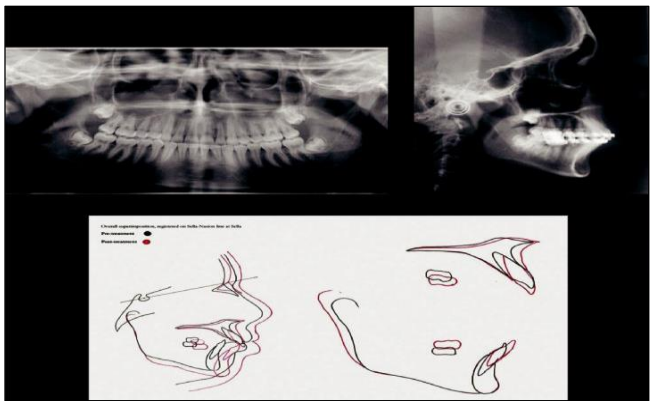

Fig 7: Posttreatment radiographs with superimpositions

Fig 8: Posttreatment photographs

The convexity of the profile and the interlabial gap at rest reduced. Lip trap was eliminated. The soft tissues adapted well to the changes in the hard tissues. Class I molar and canine relationship was achieved by a combination of skeletal and dentoalveolar changes. Although a slight relapse was observed after the functional phase, favorable intercuspation could be achieved at the end of treatment. Good cusp‑fossa relationship could be observed from the lingual aspect of the posttreatment and retention study models.

Normal overjet and overbite were established. The midlines were coincident. The maxillary incisor inclination was almost ideal. The lower incisors proclined as expecte.

Discussion

Twin Block functional appliance has several well established advantages including the fact that it is well tolerated by patient (Harradine and Gale, 2000) [3], robust, easy to repair and it is suitable to use in the permanent and mixed dentition. There are potential disadvantages such as the proclination of the lower incisors and development of

posterior open bites. In this case, the treatment objectives were achieved largely due to the good compliance by the patient.

The patient's chief complaint was the increased overjet. Thus by reducing the overjet with the functional appliance, the patient's confidence has improved and also the risk of sustaining trauma to the upper incisor was minimised. Due to the fact that the patient was instructed to activate the midline screw only twice a week (0.25 mm of expansion per turn), this may contribute to the limitation of the severity of the posterior open bite at the end of the functional appliance phase. In this case, more expansion would help to reduce the amount of the transverse discrepancy.

The posterior open bite was managed by the part time wear of the functional appliance during the transient phase between functional and fixed appliance and also by coordinating the stainless steel arch wires during the fixed appliance phase. The selection of functional appliances is dependent upon several factors which can be categorised into patient factors e.g. age and compliance and clinical factors e.g. preference/familiarity and laboratory facilitie

The superimposition of the lateral cephalometric radiographs taken during pre-treatment and pre-debond demonstrated that the patient grew in a favourable direction towards a class I skeletal pattern. The radiographs were registered on stable structures in the anterior cranial base (Decoster line). The maxilla demonstrated vertical growth.

The upper incisors were extruded and the molars moved mesially. The mandible demonstrated down and f orward growth with a slight anterior growth rotation. The lower incisors were proclined despite the use of acrylic capping which was reported to reduce the amount of lower incisors proclination (Mills and McCulloch, 1998) [9]. The lower molars moved mesially.

It has been proved in the literature that functional appliances do not produce long term skeletal changes and most of their effects are dento-alveloar (Lee *et al*. 2007) [6]. In a prospective controlled trial (Lund and Sandler, 1998) [8] with twin blocks and controls to investigate the skeletal and dental effects showed that the ANB angle reduced by 2° which was almost entirely due to mandibular length increase which was 2.4 mm compared to the controls as measured from Ar-Pog. There was no evidence of a restriction in maxillary growth. However, it can be seen in this case that functional appliance can facilitate the fixed appliance phase dramatically to achieve good result.

Conclusions

The effect of Twin Block functional appliances is mostly dento-alveloar with small skeletal component. There are a number of situations where functional appliances can be successfully used to correct class II malocclusion. It is important that functional appliances are used in a growing patient to achieve the maximum benefit. They simplify the following phase of fixed appliance by gaining anchorage and achieving class I molar relationship. In this case, the patient was treated with Twin Block appliance followed by fixed appliance phase. The design and effects of the appliance were demonstrated in this case report.

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