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CORRECTING CLASS II MALOCCLUSION IN GROWING PATIENTS USING TWIN-BLOCK FOLLOWED BY FIXED APPLIANCES: CASE REPORT

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ABSTRACT
Background: *Correcting Class II malocclusion with mandibular retrusion is challenging for orthodontists due to its multiple etiologies, especially in growing patients. The two-phase treatment is often considered effective for managing skeletal class II malocclusions in growing patients. Early intervention with functional appliances, such as Twin block, can effectively redirect growth in the desired direction.* ***Objectives:*** *This case report aims to present a two-phase orthodontic treatment approach using a Twin Block appliance followed by fixed appliances in an 11-year-old male patient with skeletal Class II malocclusion.* ***Case:*** *An 11-year-old male patient was diagnosed with skeletal class II malocclusion with a convex facial profile, retrusive chin, significant overjet (12 mm) and protrusive maxillary incisor. Pre-treatment cephalometric analysis showed SNA: 81°; SNB: 74°; <I-NA: 40°; I-NA: 7mm. Skeletal maturation assessment indicated the patient was at the peak of pubertal growth.* ***Managing cases****: A two-phase treatment approach was planned. Phase I involved growth modification using a Twin block appliance. Phase II consisted of fixed orthodontic treatment using the MBT 0.022 bracket system. The treatment was carried out for approximately 27 months, resulting in achieving skeletal class I, class I molar and canine relationship, with overjet reduced to 4 mm. Post treatment cephalometric analysis showed SNA: 81°; SNB: 78°; <I-NA: 30°; I-NA: 5.5 mm.* ***Conclusion:*** *A two-phase treatment using Twin Block followed by fixed appliances proved effective in correcting skeletal class II malocclusion with retrognathic mandible in growing patient. The treatment achieved normal occlusion, marked improvement in facial profile and patient satisfied with the result.*

Keywords: *growing patient, mandibular retrusion, skeletal class II, twin block.*

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INTRODUCTION

Class II malocclusion is one of the most prevalent orthodontic issues.[1] Correcting Class II malocclusion is challenging for orthodontists due to its multiple etiologies.[2,3] Skeletal Class II malocclusion can be caused by maxillary protrusion, mandibular retrusion, or a combination of the two.[4] However, mandibular retrognathism accounts for the majority of cases, while maxillary protrusion is observed in fewer than 20% of patients.1 Treatment options for these patients consist of functional orthopedic treatment, fixed camouflage orthodontics, and combined approach of orthodontic and orthognathic surgery.[5]

In growing patients, treatment is generally focused on correcting the developing malocclusion. Class II malocclusions in growing patients generally respond well to functional appliance that guide growth in desired direction, as long as the clinical and cephalometric findings are favorable.[6,7] Functional appliances create skeletal and dental change by using forces generated from muscles.[8] The choice of functional appliance depends on various factors such as clinical factors, age and compliance.[4]

Twin block appliance is widely regarded as one of the most effective appliances for growth modification due to its favorable outcomes, particularly in increasing mandibular length and high patient tolerance. These appliances are commonly used to treat increased overjet and Class II malocclusion.[9,10] The effectiveness of this functional appliance depends on the patient's commitment to wearing it for at least 12–14 a day over a period of 6–8 months.[11] It works by advancing the mandible, which promotes additional mandibular growth through the stimulation of the condylar cartilage and limiting maxillary growth. Using construction bite,

a new position for the lower jaw is established and transferred to the removable appliance. Over time, the mandible will maintain that position permanently.[12,13]

The two-phase treatment is often considered effective for managing skeletal class II malocclusions in growing patients. This treatment begins with growth modification using functional appliances and followed by fixed orthodontic treatment.[14] This case report presents the orthodontic management of an 11-year-old male patient with class II malocclusion, characterized by a convex facial profile, mandibular retrusion, increased overjet and moderate dental crowding, treated using a twin block functional appliance. By presenting this case, we aim to evaluate the efficacy of twin block appliance in managing patient with Class II malocclusions beyond the mixed dentition stage

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CASE

An 11-year-old male patient presented to the to the orthodontic clinic at Padjadjaran University with the chief complaint of a convex facial profile and anterior teeth protrusion (Figure 1). Extraoral examination revealed a severe convex profile, a retrusive chin, and upper lip protrusion, along with an incompetent lip seal. Intraoral examination exhibited severe maxillary protrusion with an overjet 12 mm, a deep overbite, crowding in both maxillary (1.5 mm) and mandibular dentition (3 mm). Molar and canine relationships were Angle Class II on both sides, with a 1 mm midline deviation of the maxilla to the right. Examination of the temporomandibular joint showed no abnormalities. The patient's periodontal health was good and exhibited normal swallowing, speech, and mastication, with no parafunctional oral habits noted.

Panoramic radiograph examination revealed developing third molar tooth buds in maxillary and mandibular arches (Figure 2). The lateral cephalometric radiograph (Figure 3) indicated that the patient had skeletal class II (ANB = 7°) due to a retrognathic mandible (SNB = 74°). The maxillary incisors were proclined (U1- NA = 40°; U1-NA length 7 mm), while the lower incisors were in a normal position (L1- NB = 24°). Assessment of skeletal maturity using cervical vertebrae and hand-wrist radiographs (Figure 4) indicated that the patient was at the peak of his pubertal growth phase.

Figure 1. Pre-treatment. (A, B, and C) Extraoral photographs before treatment. (D) Initial intraoral photographs of the patient revealed molar and canine Class II relationships, along with a large overjet and deep overbite (11-year-old)

Figure 2. Panoramic radiograph before appearance treatment

Figure 3. Pre-treatment lateral cephalometric

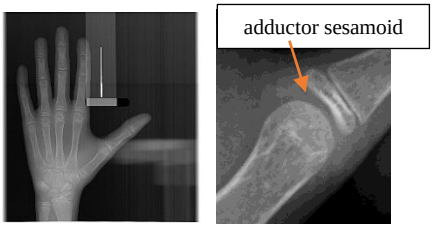

Figure 4. Hand wrist radiograph. The indicated the patient was in the SMI 4 stage

CASE MANAGEMENT

As the patient approached his pubertal growth spurt, the primary treatment goal being to promote mandibular advancement in order to correct the Class II malocclusion and enhance facial profile. After a comprehensive clinical examination, review of the records, and consideration of the patient's motivation and expectations, a two-phase treatment protocol was established.

Phase I involved growth modification using a twin block appliance, while Phase II comprised fixed orthodontic treatment using Pre-Adjusted Edgewise brackets (MBT prescription, 0.022 slot).

Modeling wax was utilized for bite registration, which aims to advance the mandible into a tolerable forward or setback position. The principles and guidelines for bite registration state that the mandible should be advanced until the upper primary canine is positioned directly above the interproximal area of the lower primary canine and first primary molars. Additionally, the upper and lower midlines should coincide during bite registration.

For this bite registration (Figure 5), 7 mm horizontal advancement and 6 mm vertical opening were planned. The step inclined planes were constructed with an interlocking angle of approximately 70° to the occlusal plane. In cases of slight mandibular asymmetry, efforts were made to correct it by encouraging differential growth of the mandible, ensuring the upper and lower midlines coinciding during the construction bite.

Figure 5. Bite registration with 7 mm horizontal advancement and 6 mm vertical opening

Figure 6. Intraoral photographs with twin block appliance

Phase I treatment was conducted using the mini-fixed twin block appliance with lateral expansion to relieve crowding (Figure 6). This phase lasted approximately 13 months, resulting in a skeletal class I relationship, improved facial profile, relieved crowding, and the achievement of a desirable overjet and overbite (Figure 7). The patient showed significant improvement included normalization of the overjet and overbite, with the overjet reduces from 12 mm to 4 mm. Class I relationships were achieved in the incisors, canines, and molar on both the left and the right side. The treatment goals of this phase were successfully achieved due to the patient's good compliance.

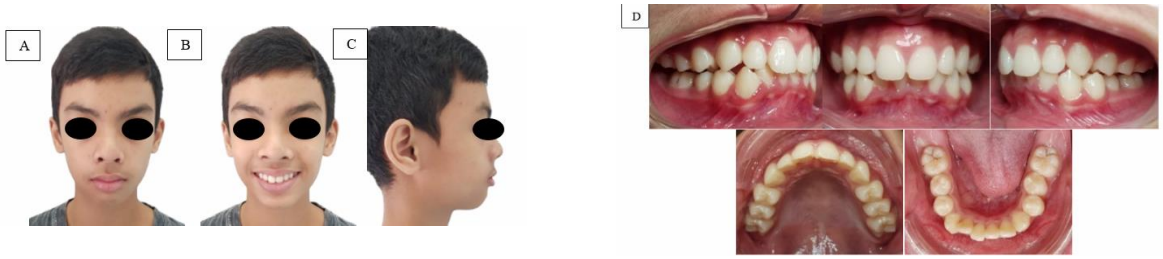

Figure 7. Post twin block appliance treatment records. (A, B and C) The extraoral photographs showed significant improvement in the profile. (D) The intraoral photograph showed improvement on interdigitation (13-year-old)

Cephalometric evaluation indicated favorable sagittal changes in jaw relationships, with skeletal measurements shifting toward a Class I pattern. These skeletal improvements were accompanied by enhanced dental alignment and soft tissue aesthetics. After mandibular advancement achieved, dental corrections were planned through phase II treatment (Figure 8).

Phase II started with fixed orthodontic treatment using the 0.022 MBT prescription bracket system (Figure 9). The primary goals of this phase were to maintain the achieved skeletal Class I relationship, resolve crowding in both arches, and achieve ideal dental alignment and leveling. A structured sequence of archwires was used to achieve the final detailing of the occlusion. Alignment was accomplished with NiTi wires, starting with 0.014 NiTi, followed by 0.016 NiTi, 0.018 NiTi, 16x22 NiTi, and finally, 19x25 stainless steel (SS) wires. This treatment has several advantages, including more efficient crowding relief, creating a normal overjet, and an enhancement in the patient's self-esteem. Class II elastics (Figure 10) were worn full time to achieve bilateral Class I canine relationship. After 15 months of continued fixed appliance therapy, ideal overbite and overjet were achieved. Final arch alignment and interdigitation detailing resulted in ideal intercuspation and bilateral class I canine occlusion.

The entire treatment was completed in 27 months. Post-treatment extraoral photographs (Figure 11) revealed significant improvement in facial profile aesthetics. Midline discrepancy was resolved, and hawley appliance (Figure 12) was used as a retainer for both maxillary and mandibular arches. After the clinical and radiographic examinations, patient was diagnosed with class I dentoskeletal malocclusion, the overbite was reduced from 3.5 to 1.5 mm and the overjet was corrected from 12 to 2 mm (Figure 13). Post-treatment orthopantomography was taken after all brackets were debonded (Figure 14).

Patient rejected for third molar extraction. Post-treatment cephalometric (Figure 15) changes are listed in Table 1. Comprehensive superimposition of pre- and post- treatment lateral cephalograms is presented in Figure 16, demostrating the skeletal and dental changes achieved. Pre- and post-treatment lateral cephalometric superimpositions showed advancement of mandible

Figure 9. Fixed orthodontic treatment with MBT prescription

Figure 10. Class II elastics on both sides to achieve the class I relationship

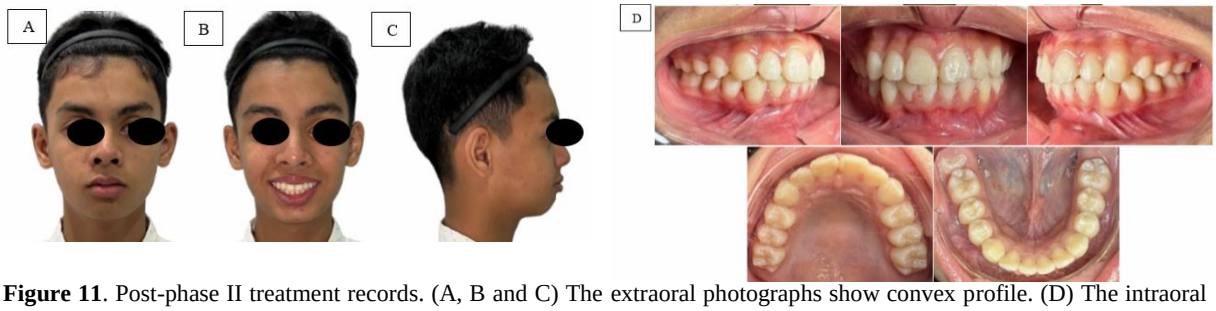

Figure 11. Post-phase II treatment records. (A, B and C) The extraoral photographs show convex profile. (D) The intraoral photographs show molar and canine class I relationship and good interdigitation

Figure 12. Hawley retainer was chosen for both maxillary and mandibular arch

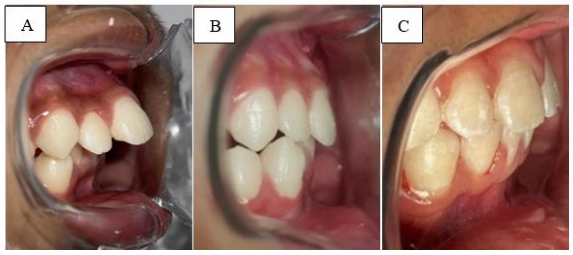

Figure 13. Overjet. (A) Pre-treatment (12 mm). (B) After using the twin block appliance (4mm). (C) Post-treatment (2mm).

Figure 14. The panoramic radiograph after treatment

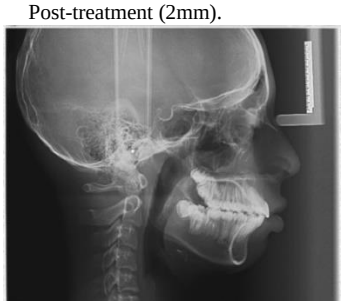

Figure 15. Post-treatment cephalometric

DISCUSSION

Class II malocclusion may result from a combination of skeletal discrepancies, soft tissue imbalances, dental misalignment, and oral habits.[3] Orthodontic practitioners should take these factors when determining the most appropriate treatment approach for their patients.[15] In cases where the malocclusion is caused by abnormal maxillary and/or mandibular growth, functional appliances can modify the direction and rate of growth.[8]

Functional appliances, either removable or fixed, are typically used during active growth periods to maximize mandibular skeletal change.[16] Several appliances, including the Twin Block, Frankel II appliance, Activator-Headgear combination, Herbst, and Bionator can encourage mandibular development and create a good skeletal relationship.[17]

Growth modification is the method of choice for treating skeletal Class II malocclusion in circumpubertal ages, and twin block is one of the most popular functional appliances for this purpose. The twin block is universally popular due to its versatility for simultaneous anterior-posterior, vertical and transverse correction. Twin block has several advantages, including suitable for both permanent and mixed dentition, compatible with fixed orthodontic appliances, cost-effectiveness, simplicity to fabricate, simplicity to adjust or repair, and high levels of patient tolerance.[19,20,21]

The goal of early functional treatment within a two-phase approach is to intercept developing problems and facilitate later treatment with fixed appliance.[8] The main objectives for phase I were to reduce overbite and overjet and to establish a class I molar relationship. Phase II focuses on resolving crowding in the lower arch and achieving ideal leveling and alignment. The optimal timing for Twin-block therapy is during or slightly after the onset of the pubertal growth spurt.[22]

In this case, a twin block is indicated since patient was in active growth phase. The developmental stages evaluation indicated that the patient was close to the pubertal growth peak. Hand wrist radiograph showed the patient was at SMI stage 4, indicating that he was at prepubertal mandibular growth peaks with a significant amount of growth remaining. The patient was in CVM CS3 stage, indicating that he was undergoing a pubertal growth spurt during the active twin block phase. The twin block appliance helps correct mandibular deficiencies by encouraging mandibular postural changes. Since the effectiveness of removable functional appliances is highly depends on the patient's compliance, using a more tolerable appliance like the twin block can make it a favorable choice for maximizing treatment success.[3]

Table 1. Cephalometric Analysis Pre- Treatment and Post-Treatment

Measurement	Normal	Pre-Treatment	Post-Twin Block	Post-Treatment
Skeletan Pattern				
SNA (°)	82 ± 2	81	81	81
SNB (°)	80 ± 2	74	77	78
ANB (°)	2 ± 2	7	4	3
Wits Appraisal	1 ± 2	3	2.5	2
Angle of Convexity (°)	0 ± 10	15	12	6
Y- Axis (°)	60 ± 6	55	54	61
Facial angle	87 ± 5	87	91	94
Dental Pattern				
U1-NA (°)	22 ± 10	40	15	30
U1-NA (mm)	4 ± 2	7	2	5.5
U1-NB (°)	25 ± 5	24	30	32
U1-NB (mm)	4 ± 2	3.5	4.5	6
Interincisal angle (°)	131 ± 10	112	130	115
Soft Tissue				
UL - E-line (mm)	2-3 mm behind E-line	3mm in front of E-line	1.5 mm in front of E-line	1.5 mm in front of E-line
LL - E-line (mm)	1-2 mm behind E-line	6 mm in front of E-Line	2.5 mm in front of E-Line	2 mm in front of E-Line

For bite registration, a 7 mm horizontal advancement and 6 mm vertical opening were planned. The steep inclined planes interlocked at approximately a 70° angle to the occlusal plane. Initially, Twin Block appliances were constructed with bite blocks set at 90° (Figure 17), requiring patients to actively posture their mandible forward, which often proved difficult to maintain. To overcome this challenge, the appliance was modified to include guiding planes angled at 45° to the mandibular plane, facilitating more passive mandibular advancement. The 70° configuration used in this case effectively encouraged a forward mandibular position by generating horizontal force components, and shortly after insertion, muscular adaption was observed.[23]

The second phase of treatment involved the use of the MBT straight-wire appliance. Significant improvements were recorded in several parameters, including mandibular length, ramus height, skeletal angles such as SNB and ANB. Normal overjet and overbite were achieved due to favorable changes in the inclination of the anterior teeth. This sequential approach, functional appliance therapy followed by fixed orthodontics, yielded stable outcomes, with minimal relapse, particularly in the correction of overjet.[19] Overall, this case illustrates the efficacy of a phased treatment strategy, highlighting the value of functional appliances in early skeletal correction and the role of fixed appliances to achieve optimal outcomes.

CONCLUSION

A two-phase treatment using Twin Block followed by fixed appliances proved effective in correcting Class II division 1 malocclusion with retrognathic mandible in growing patient. The treatment achieved normal occlusion, marked improvement in facial profile and patient satisfied with the result.

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SUPPLEMANTARY FILE

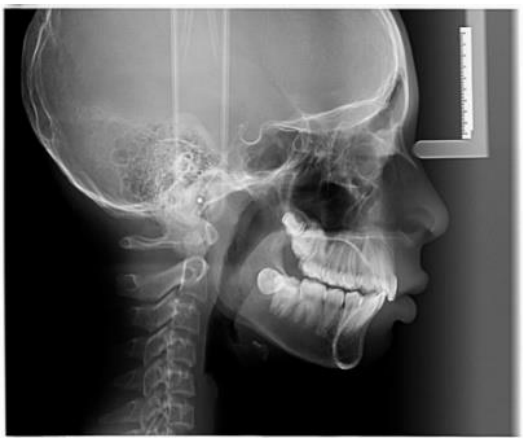

Figure 8. Lateral Cephalometric after phase I treatment showed a skeletal class I relationship with improvement in mandibular advancement

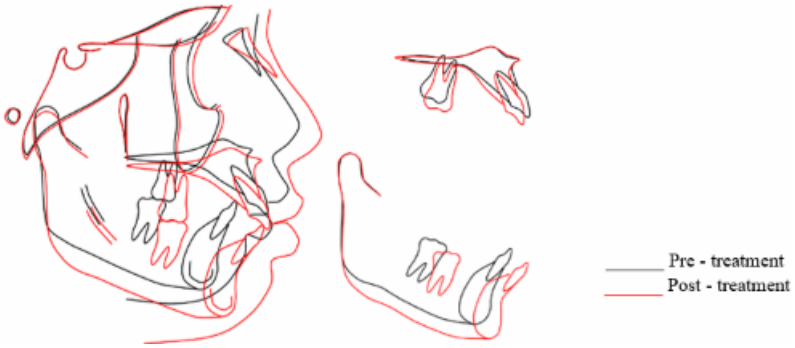

Figure 16. Pre- and post-treatment lateral cephalometric superimpositions

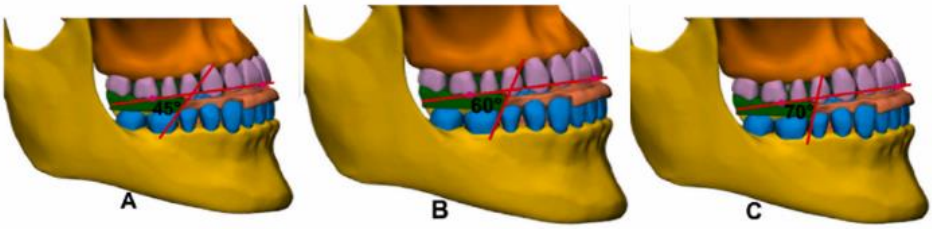

Figure 17. The inclined planes. (A) 45°; (B) 60°; (C) 70°