Full-step Class II Correction Using a Modified C-palatal Plate for Total Arch Distalization in an Adolescent

Han SH[*]/ Park JH[**]/Jung CY[***]/Kook YA[****]/ Hong M[*****]

A 13-year-old adolescent male patient had a convex profile, severe overjet, and deep overbite with a skeletal Class II pattern. His maxillary dentition was distalized using a modified C-palatal plate (MCPP), and the treatment outcome was stable. After 37 months of total treatment, a pleasing profile and a favorable Class I occlusion was successfully achieved with 5 mm of distalization in the maxillary dentition. MCPP is a viable treatment option for full-step Class II in adolescents, especially when the patients/parents decline the extraction option.

Key words: Cl II malocclusion, molar distalization, non-extraction, MCPP, TADs

INTRODUCTION

The correction of a full-step Class II malocclusion with severe overjet poses a challenge in treatment planning because it may not be simple to reach a clinical decision regarding the extraction versus distalization options.[1-3] Successful treatment involves the control of three-dimensional tooth movements.[4]

Adults with full-step Class II malocclusions, excessive overjet, and deep bite have traditionally been treated using extraction and maxillary anterior intrusion due to the efficiency of this treatment approach,[2-5] however, some patients/parents prefer the non-extraction route. Successful non-extraction treatment depends on effective distalization of maxillary dentition, but distal movement of the molars using molar distalizers such as the pendulum and distal jet is accompanied by unfavorable side-effects.[6,7] The Forsus appliance can significantly reduce overjet, but its correction usually involves mesialization of mandibular molars and proclination of mandibular incisors.[8-10]

Recently, temporary anchorage devices (TADs) have offered alternative biomechanical methods to achieve orthodontic space management in the posterior region; therefore, molar distalization can be a practical treatment option to correct a Class II malocclusion.[11-15] For total arch distalization of the maxillary dentition, different types of TADs such as interradicular miniscrews or palatal miniscrews with palatal plates may be effectively used. [16, 17]

Several studies have confirmed the suitability of the palate as a skeletal anchorage site in adolescents because of bone thickness, density, and soft tissue thickness.[18-20] Recently, Kook *et al* reported the application of a modified C-palatal plate (MCPP) appliance for total distalization of maxillary dentition in adolescents.[21]

The long-term stability results with extraction treatment options have not been evaluated sufficiently. A recent study showed that the reopening of the closed extraction space occurred in about 30% of the cases after 1 year of retention.[22] This may indicate a relapse from previous extraction treatment and could create esthetic and periodontal problems from food impaction.

This article presents a treatment modality for total arch distalization using MCPP in full-step Class II adolescent patients.

Clinical case

A 13-year-old boy had a chief complaint of a protrusive upper lip. He had a long upper lip, retrusive chin, Class II skeletal pattern with full-step Class II molar and canine relationships with 6 mm overjet and an impinging overbite (Fig 1). There was moderate 3-4 mm crowding in the maxillary arch and mild 2-3 mm spacing in the mandibular arch with no dental midline deviation (Fig 2). The

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maxillary left second molar was emerging and all third molars were developing (Fig 3). He had no significant skeletal asymmetry or symptoms of temporo-mandibular joint disorder.

A lateral cephalometric analysis indicated a skeletal Class II (ANB, 7.0°; Wits appraisal, 1.0 mm) with hyperdivergent growth pattern (FMA, 28.0°). The maxillary and mandibular incisors compensated for the skeletal discrepancy (U1-FH, 105.0°; IMPA, 95.0°). The mandible was retrusive with normal labiomental fold. (Pog-N perpend, -2.0 mm; labiomental fold, 116 °; Table 1).

Treatment Objectives

The treatment objectives were to obtain Class I molar relationship with normal overjet and overbite, to resolve crowding and spacing, and to improve the patient's profile.

Treatment Alternatives

There were two treatment options: the first was to extract the maxillary premolars and retract the anterior teeth to Class I canine and Class II molar relationships. The second was to distalize the maxillary dentition using a palatal plate without extraction. Since

Figure 1. Pretreatment facial and intraoral photographs.

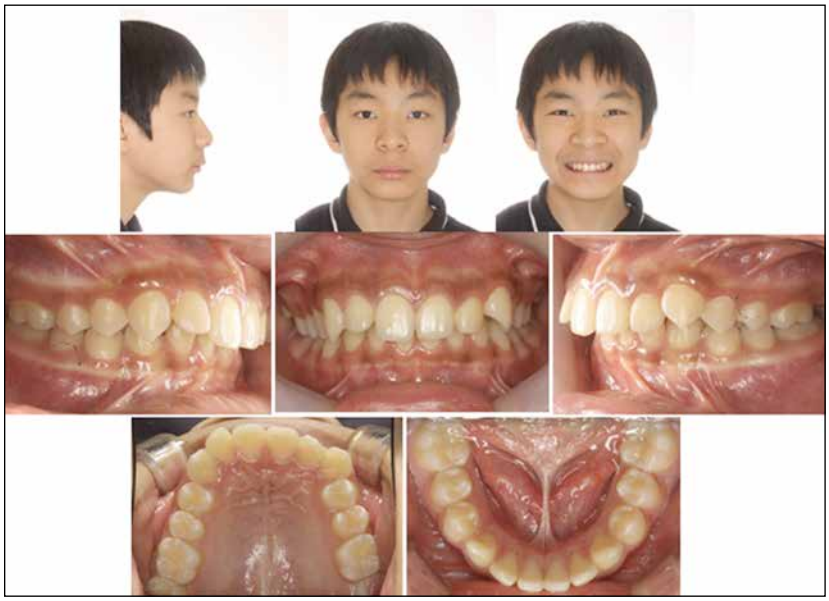


Table 1. Lateral cephalometric analysis

Measurement	Mean	Pretreatment	Posttreatment	Difference
SNA (°)	82.0	79.0	79.0	0.0
SNB (°)	80.0	72.0	71.0	-1.0
ANB (°)	2.0	7.0	8.0	1.0
A point–N Perpend (mm)	1.1	5.5	5.0	-0.5
Pog- N Perpend (mm)	-0.3	-2.0	-6.0	-4.0
Wits (mm)	-2.2	1.0	2.5	1.5
Harvold (mm)	35.8	21.5	23.0	1.5
Facial Height Ratio (P/A) (%)	66.4	56.5	54.5	-2.0
FMA (°)	24.0	28.0	30.0	2.0
ODI (°)	73.3	71.5	72.5	1.0
U1 to FH (°)	116.5	105.0	96.0	-9.0
IMPA (°)	90.0	95.0	93.5	-1.5
Interincisal angle	124.0	130.0	138.0	8.0
FH to occlusal plane (°)	10.5	15.0	16.0	1.0
TVL to UL (mm)	5.0	4.5	3.5	-1.0
TVL to LL (mm)	2.5	-2.0	-2.0	0.0
TVL to Pog' (mm)	-3.0	-9.0	-11.5	-2.5
Nasolabial angle (°)	85.0	88.0	96.0	8.0
Labiomental angle (°)	100.0	116.0	118.0	2.0

Figure 2. Pretreatment dental casts.

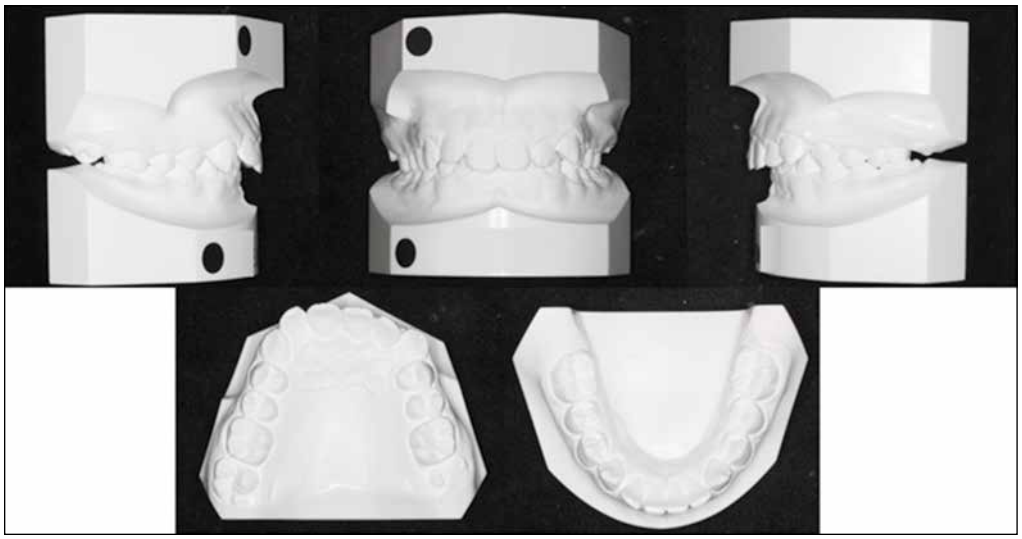
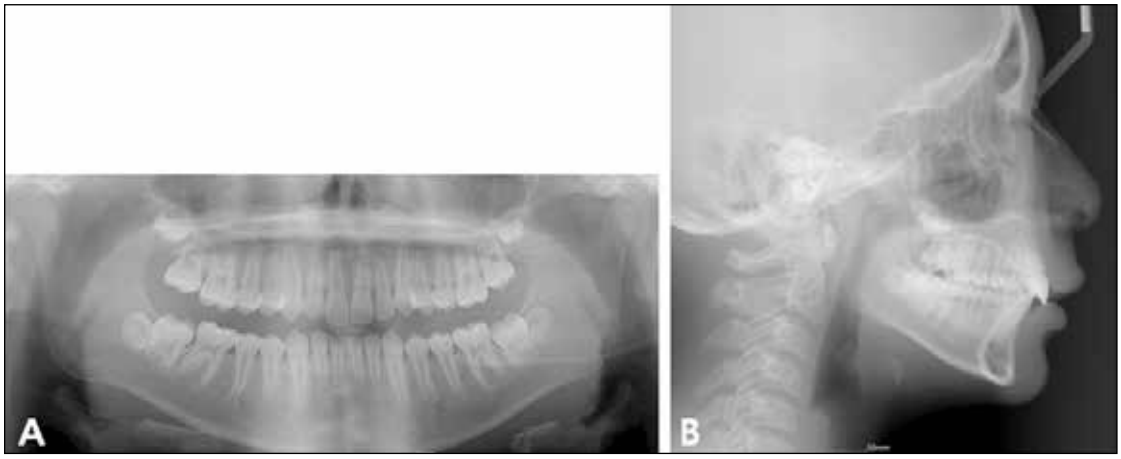


Figure 3. Pretreatment radiographs: A, panoramic radiograph; B, lateral cephalogram.



the maxillary crowding was moderate and maxillary incisors were upright (U1-FH, 105.0°), extraction of premolars would have resulted in retroclination of the maxillary incisors when retracting the anterior teeth. Therefore, the second treatment option was selected.

Treatment Progress

The patient was bonded with preadjusted 0.022-in Roth (Clippy-C, Tomy, Tokyo, Japan) brackets. After initial leveling and alignment, a MCPP device was fixated with 3 miniscrews (2mm X 8mm; Jeil Medical, Seoul, Korea). A rigid palatal arch along and apical to the gingival margin was soldered to the bands on the maxillary first molars.

Elastomeric chains were engaged between the hooks of the palatal arch and the palatal plate hooks and 250g of force per side was applied to distalize the whole maxillary dentition. Force vectors were designed to help vertical control of the maxillary 1st molar. After achieving the super Class I molar relationship, distalization was stopped (Fig 4).

During the finishing stage, the occlusion was settled with vertical and Class III elastics. Lingual fixed retainers were bonded on both the maxillary and mandibular dentitions, and circumferential retainers were delivered as well.

Figure 4. (A) Delivery of MCPP for maxillary arch distalization; (B) after 7 months of distalization.

TREATMENT RESULTS

Overjet and overbite were improved and Class I canine and molar relationships were achieved (Figs 5 and 6). A posttreatment radiograph showed acceptable root parallelism with no significant sign of bone or root resorption (Fig 7). Both maxillary and mandibular incisors were uprighted (U1- FH, 105.0° to 96.0°; IMPA, 95.0° to 93.5°).

The maxillary incisors were originally upright and hence there was a special need to improve/maintain maxillary incisor angulation. It was worsened by the treatment, which originated mainly from reducing the larger overjet (7 mm) compared to the amount of total distalization (5 mm) under insufficient maxillary torque control. During distalization, utilizing extra supportive auxiliaries such as torquing wires would have been helpful.

However, if the extraction option had been selected for this case, it would have been more difficult to prevent retroclination of the maxillary incisors during space closing. The vertical growth pattern of the patient and slightly uprighted mandibular incisors compared with pretreatment were also unfavorable conditions for improving maxillary incisor angulation due to the amount of space to be closed in the mandibular anterior segment.

From the true vertical line, the horizontal position of the upper lip changed from 4.5 to 3.5 mm, while the lower lip remained at -2.0 mm. The mandibular plane angle slightly increased from 28.0° to 30.0°, and the occlusal plane angle from 15° to 16° (Fig 8 and Table 1). Total treatment time was 37 months.

The patient maintained a good occlusion and profile 22 months after the end of treatment (Figs 9 and 10). Continued growth in the maxilla and mandible was visible in the lateral cephalogram.

Figure 5. Posttreatment facial and intraoral photographs.

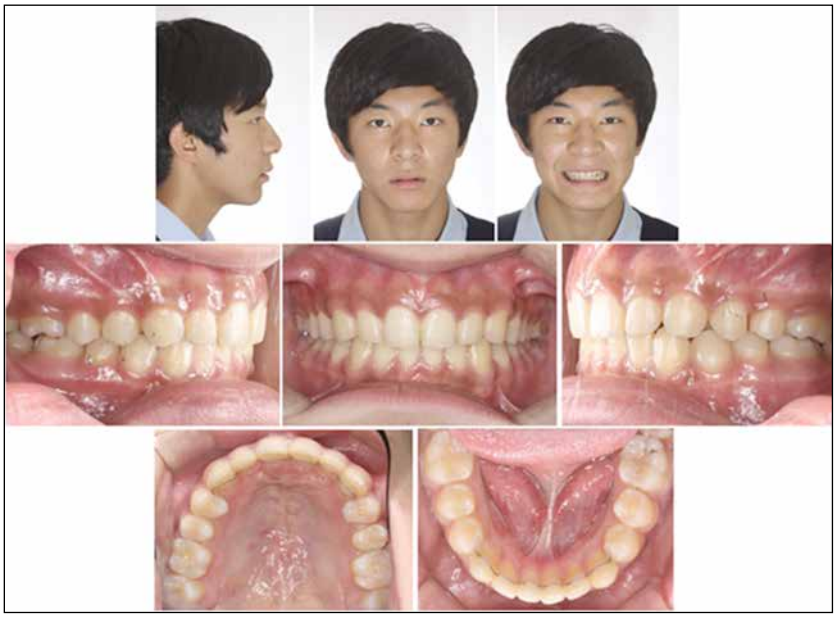


Figure 6. Posttreatment dental casts.

Figure 7. Post treatment radiographs: A, panoramic radiograph; B, lateral cephalogram.

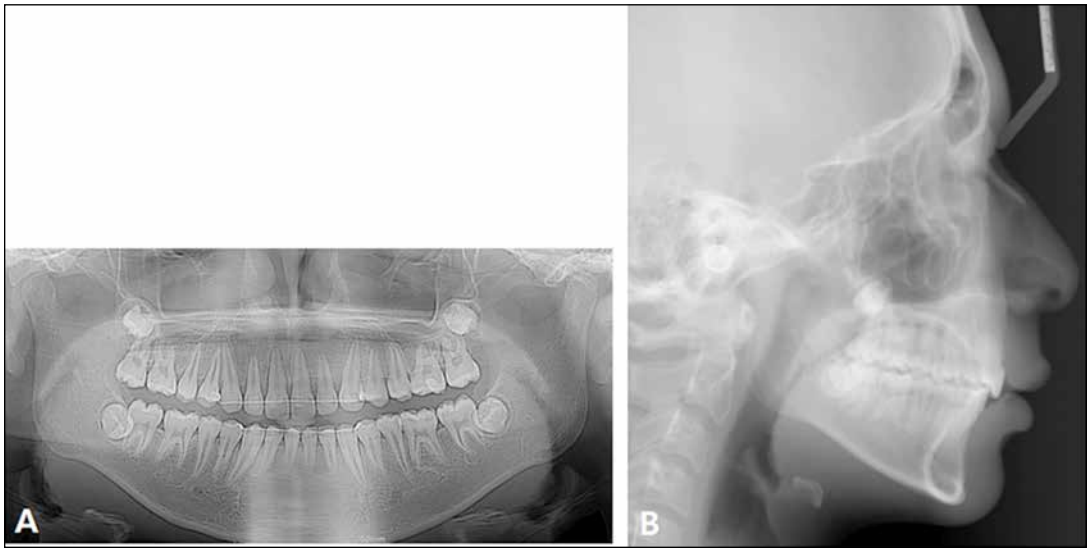
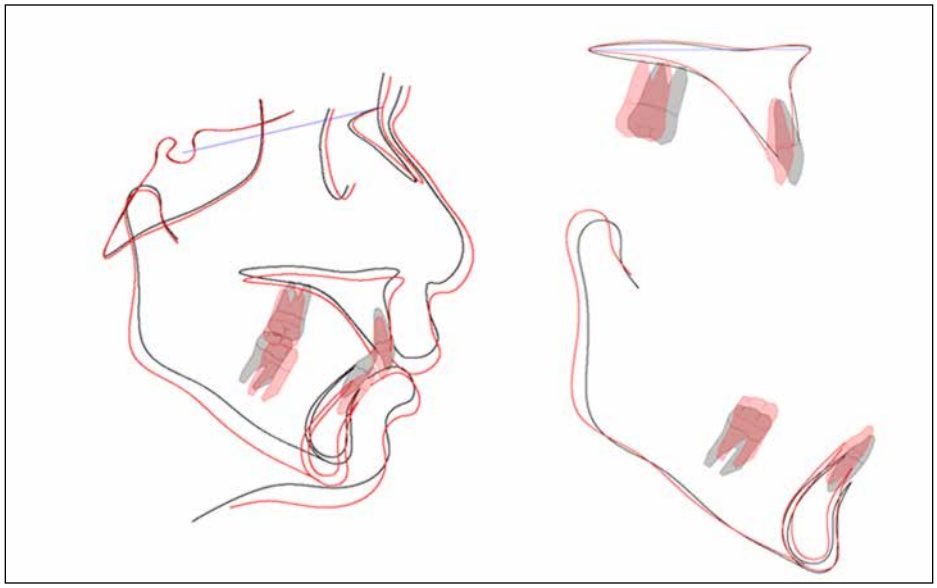


Figure 8. Pre and post treatment superimposition.



DISCUSSION

Conventionally, headgear is considered for treatment of a Class II malocclusion with a deep bite in growing patients.[23] However, it has several disadvantages including an adverse social effect on the patient and an increased amount of distal tipping. Moreover, its treatment effect is dependent on the patient cooperation.[24]

Fuziy *et al.* reported that the mean distalization of the maxillary molars using a pendulum appliance was 4.6 mm, with a mean distal crown tipping of 18.5° and maxillary molar expansion with a rate of about 1 mm per month.[25] However, intraoral molar distalizers such as pendulum and distal jet caused undesirable effects in maxillary dentition due to increased tipping and extrusion of the molar.[6, 7]

Cacciatore *et al.* reported that the Forsus appliance presented a significant dentoalveolar effect with 4.3 mm improvement in the molar relationship; 2.0 mm of the correction was due to mesialization of mandibular molars.[8] Fixed functional appliances such as Forsus and Herbst are effective at reducing overjet in growing patients by proclining mandibular incisors.[9,10] On the other hand, the palatal plate has been introduced as an innovative non-compliance appliance for maxillary molar distalization without proclining mandibular incisors. [3, 14, 15]

In our case, the maxillary dentition was distalized about 5 mm on each side to correct the severe overjet. Distalization was accomplished without extrusion of the first molar and with limited distal tipping. A previous report showed an average of about 3.1 mm of maxillary molar distalization and 1.5° distal tipping when using the MCPP in adolescent patients.[23]

The pretreatment records of our patient show tight inter-digitation of molar and premolar area, a condition that might prevent the forward growth of the mandible. Therefore, the use of a MCPP was advantageous in this case. Intrusion of the maxillary posterior teeth by MCPP might result in unlocking the mandibular growth, and hence enhance the treatment results and improve the facial appearance of the patient.

Figure 9. Facial and intraoral photographs after 2 years.

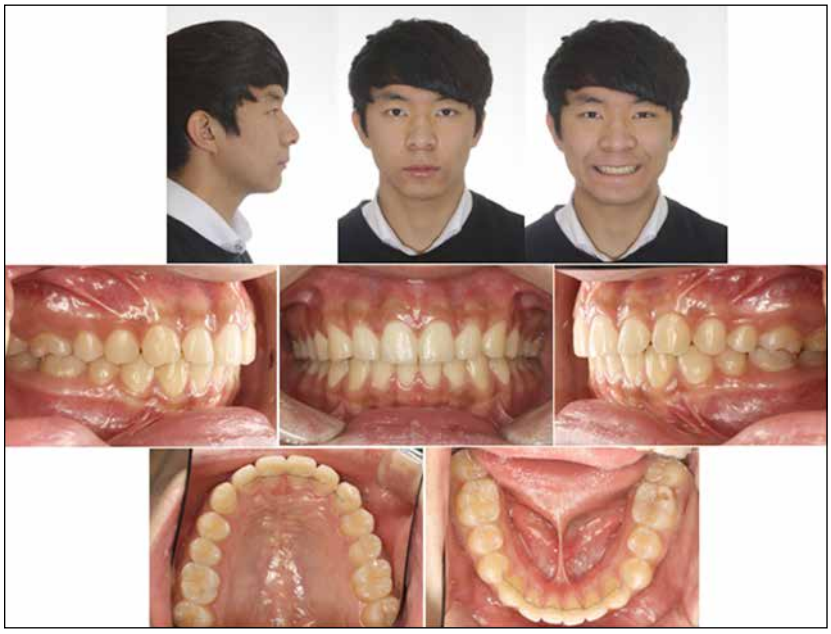
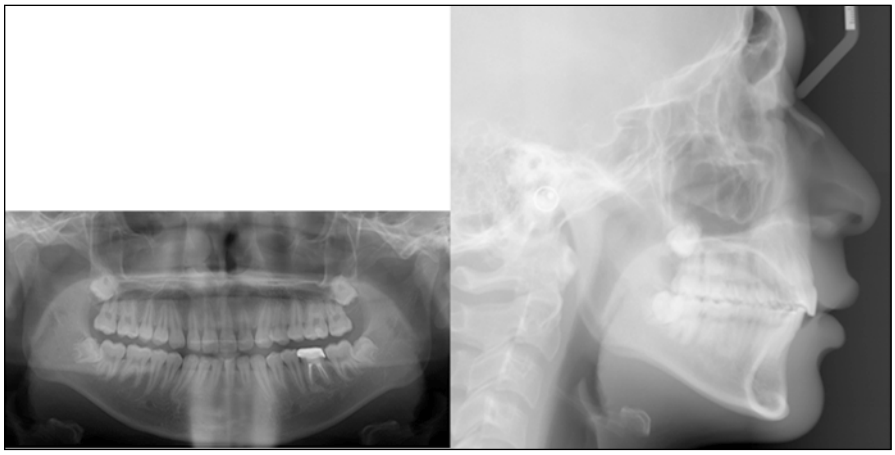


Figure 10. Retention radiographs 2 years: A. panoramic radiographs; B. lateral cephalogram.



The total effect on the molars might show slight extrusion; this can be explained by the effect of the growth. Previous research in adolescents showed that the downward growth of the maxilla could mask the intrusion effect of MCPPs.[23]

In our case, one of the treatment options was to extract the first premolars and retract the anterior segment. However, this treatment option may cause re-opening of the extraction space as the extraction sites have a higher likelihood of relapse during a retention period.[22] Total arch distalization avoids the problems associated with the extraction treatment.

Stability of distalization depends on the amount of molar root movement. For instance, the application of buccally placed miniscrews would not provide enough distalization by itself because narrow interradicular space requires miniscrew relocation during the treatment. The 22-month retention records of our patient showed good stability, and this might have been due to the effective root movement. From the panoramic radiograph, no significant sign of root resorption was observed.

At the beginning of the treatment, the third molar tooth buds were not in a position that could affect the distalization process; therefore, there was no pressing need to extract them surgically. At debonding, the developing third molars were still not adversely affecting the maxillary dentition. However, some concerns might be raised regarding their close proximity to the roots of the second molars.

A future study comparing the extraction treatment to the total arch distalization might be recommended, with a special consideration for the stability of the treatment effects.

CONCLUSION

The distalization of the maxillary dentition using a MCPP was successful and the treatment outcome was stable. The application of MCPPs is a viable treatment option for full-step Class II correction for adolescents.

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