

Management of skeletal Class III with facial asymmetry using skeletal anchorage: 4-year follow-up

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Introduction: Skeletal Class III malocclusion with asymmetry is one of the most difficult problems to correct in orthodontics. A functional shift of the mandible in growing patients may occur accompanying a Class III, due to constricted maxillary arch and occlusal interferences. Studies have indicated that posterior unilateral crossbite develops early and has a low rate of spontaneous correction. It may further lead to development of mandibular and facial asymmetry by growth and displacement of mandible if left untreated in growing patients. **Objective:** This article reports the clinical case of a thirteen-year-old female patient in CVMI transition stage that had maxillary hypoplasia with a developing facial asymmetry. **Results:** The case was successfully managed with bone-anchored facemask therapy and with elimination of occlusal interferences with guided occlusion. Reverse twin block in the retention phase maintained the results achieved. **Conclusion:** A four-year follow-up evaluation revealed successful maintenance of the treatment results.

Keywords: Maxillary hypoplasia. Facial asymmetry. Skeletal anchorage.

Introdução: A má oclusão de Classe III esquelética com assimetria é um dos problemas mais difíceis de se corrigir na Ortodontia. O desvio funcional da mandíbula em pacientes em fase de crescimento pode ocorrer acompanhado da Classe III, devido à atresia maxilar e interferências oclusais. Estudos têm indicado que a mordida cruzada posterior unilateral se desenvolve precocemente e apresenta baixo índice de correção espontânea. Isso pode levar ao desenvolvimento de assimetria mandibular e facial, resultante do crescimento e deslocamento da mandíbula, caso os pacientes não sejam tratados na fase de crescimento. **Objetivo:** O presente artigo relata o caso clínico de uma paciente com treze anos de idade, com IMVC em estágio de transição e que apresentava hipoplasia maxilar com assimetria facial em desenvolvimento. **Resultados:** O caso foi tratado com sucesso por meio de terapia com máscara facial osseossuportada, eliminando as interferências oclusais por meio de uma oclusão guiada. O uso do aparelho Twin-block reverso como contenção preservou os resultados atingidos. **Conclusão:** O acompanhamento após quatro anos confirmou a manutenção dos resultados do tratamento.

Palavras-chave: Hipoplasia maxilar. Assimetria facial. Ancoragem esquelética.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

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INTRODUCTION

Maxillary hypoplasia in anteroposterior direction in skeletal Class III malocclusion is often accompanied by transverse deficiency of maxilla.^{1,2,3} Due to the transverse constriction of maxilla, the occlusal interferences exist as the mandible closes into centric occlusion, resulting in functional shift of mandible to one side.^{4,5} This leads to the development of a unilateral posterior crossbite. Studies have indicated that posterior unilateral crossbite develops early and has a low rate of spontaneous correction.^{6,7} In addition, functional condylar adaptation occurs in concordance with functional mandibular displacement, which may progress into morphologic asymmetry.^{8,9,10}

Treatment of such a case is considered to be challenging, and it requires close observation, with accurate diagnosis and prompt intervention in growing age.

The present article reports the treatment and four-year follow-up of a thirteen-year-old female patient during cervical vertebrae maturity¹¹ transition stage, who presented maxillary hypoplasia, with a developing facial asymmetry. She had skeletal Class III malocclusion with maxillary retrusion, mandibular deviation to the right side, and a unilateral posterior crossbite.

CASE REPORT

Diagnosis and etiology

A thirteen-year-old female patient presented to the clinical service at the Department of Orthodontics of Maulana Azad Institute of Dental Sciences, with the chief complaint of irregular teeth, and no relevant medical or dental history. On extraoral examination (Figs 1A-C), the patient presented dolichocephalic facial form, with straight profile and straight divergence. Midfacial deficiency with lack of zygomatic prominence was present as well. It was also observed that there was facial asymmetry in the lower third of the face, with deviation of chin to the right side. No symptoms of temporomandibular joint disorder were present. Intraoral examination (Figs 1D-H) revealed a Class III molar relationship on both sides, with posterior crossbite in right premolar/molar region. Mild crowding in both maxillary and mandibular arches was present. Mandibular dental midline was shifted 4.5 mm to the right side, with negative overjet of 1 mm and positive overbite of 3.5 mm. Lateral cephalometric analysis (Table 1 pre-

treatment values) revealed a Class III skeletal pattern (ANB = -1°) with a retrognathic maxilla (SNA = 79° , Na perpendicular to Point A = -5mm) and orthognathic but hyperdivergent mandible (SNB = 80° , SND = 78° , Na perpendicular to Pog = -7.5mm, FMA = 39°). The patient had vertical growth pattern (Y axis = 67°) and she was during CVMI transition stage (Stage 3). PA cephalogram confirmed the facial asymmetry in lower third of face, with deviation of Menton point towards right side by 4.5 mm (MSR- Me = +4.5 mm).

The case was diagnosed as a Class III skeletal malocclusion with retrognathic maxilla and orthognathic mandible. She had vertical growth pattern and facial asymmetry in lower third of face, with chin deviated 4.5 mm to right. As for the occlusal features, the patient had an Angle Class III type 3 malocclusion, with posterior crossbite in right premolar/molar region. The patient had midface deficiency, with lack of zygomatic prominence and retrusive upper lip.

Treatment objectives

The following treatment goals were established:

1. To correct the skeletal discrepancy and asymmetry.
2. To restrain the vertical growth pattern.
3. To relieve crowding in maxillary arch.
4. To achieve normal overjet and overbite.
5. To achieve stable molar relationship and occlusion on both sides.
6. To improve the soft tissue profile.

Treatment alternatives

For such a patient in transition stage and vertical growth pattern, conventional facemask therapy is skeptical in terms of its outcome.

Considering the patient's biological age, the Class III profile with deficient maxilla and facial asymmetry, it was decided for maxillary protraction with bone-anchored protraction facemask therapy, to enhance the use of remaining growth potential at the transition stage. Since most of the mandibular asymmetries in growing Class III cases are due to bilateral constriction of maxilla, it was decided to eliminate the constriction of maxilla by rapid maxillary expansion prior to facemask therapy and hence, stop the developing mandibular asymmetry. Camouflage treatment

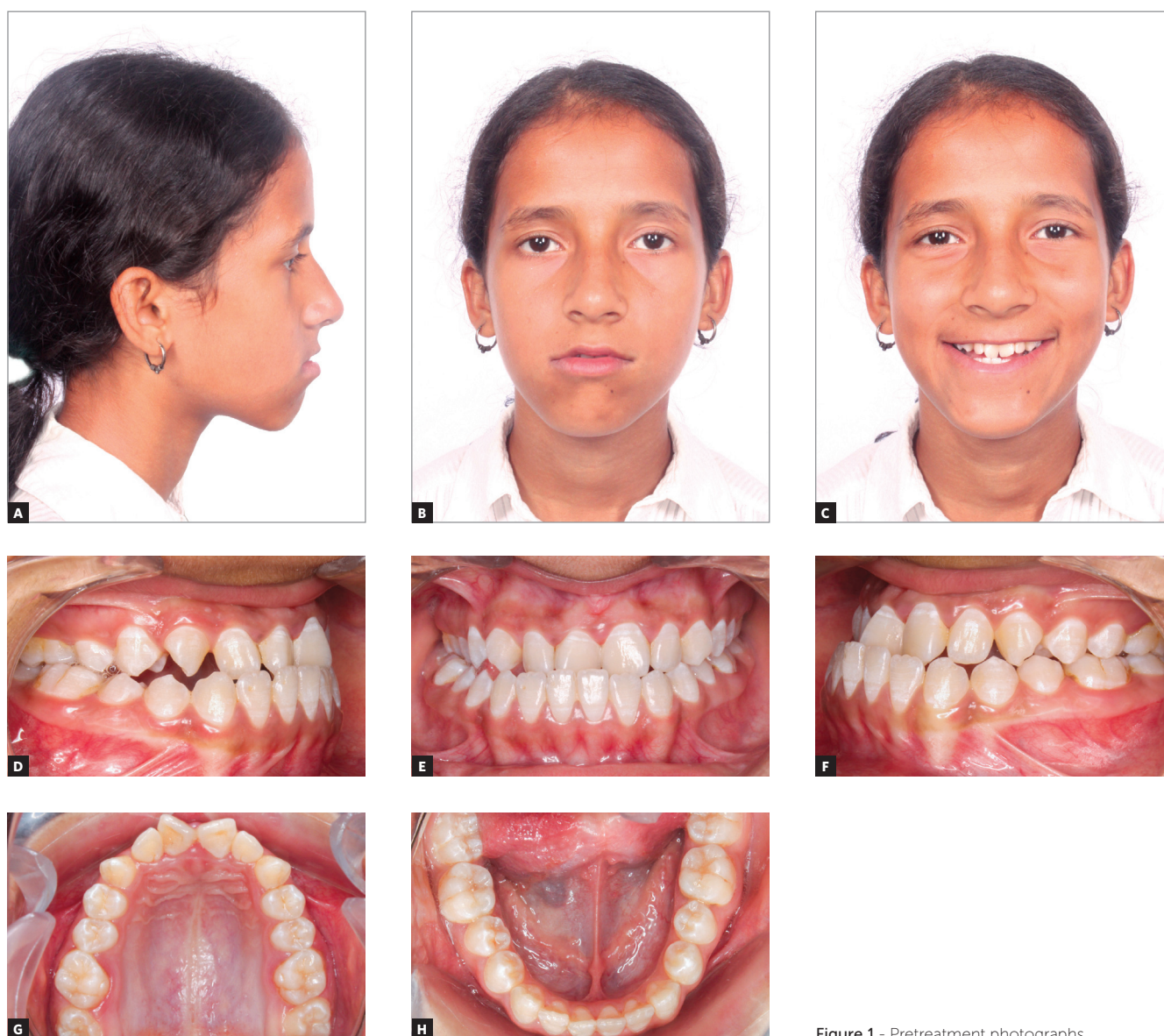


Figure 1 - Pretreatment photographs.

option was not considered for this patient, because it would not treat the true maxillary hypoplasia and would not result in facial fullness in the middle third of face.¹² Also, the mandibular asymmetry would not have been addressed. Surgical treatment option was excluded because of the patient's biological age and her unwillingness for a future major surgical intervention.

Treatment progress

The treatment duration and the surgical procedure were explained to the patient and her parents, along with the expected outcome, treatment alternatives and retention plan. Then, a written consent was obtained.

Titanium-coated miniplates based on the design used by Kircelli and Pekta¹³ were placed in the lateral nasal wall area by an oral and maxillofacial surgeon (Fig 2). The miniplates were first meticulously contoured to the bilateral nasal walls. The straight extensions were bent into a J-hook shape and were made to project into the oral cavity through an incision in the attached gingiva in lateral incisor/canine region, for the purpose of attaching elastics.

After two weeks of soft tissue healing, rapid maxillary expansion was started. Maxillary protraction with facemask started with force of 8 ounces/side and high-pull chin cup wear was advised for a duration of 16 hours/day (Fig 3). Force levels gradually increased

Table 1 - Cephalometric measurements.

S. No	Cephalometric parameter	Normal (Mean)	Pretreatment	Posttreatment	Postretention
Maxilla					
1.	SNA	82°	79°	82°	82°
2.	Na perp Pt A	0-1mm	-5mm	-1mm	-1.5mm
Mandible					
3.	SNB	80	80	78	78°
4.	SND	76°	78°	77°	77°
5.	Na perp Pog	-8 to -6mm	-7.5mm	-8mm	-8mm
Skeletal pattern & Growth pattern					
6.	ANB	2°	-1°	3°	3°
7.	Y-axis	59°	67°	68°	67°
8.	GoGn-SN	32°	36°	38°	39°
9.	FMA	25°	39°	40°	40°
Dentition					
10.	Upper 1 to SN	102°	99°	100°	100°
11.	Upper 1 to NA	22°, 4mm	18°, 5mm	22°, 4mm	21°, 4mm
12.	Lower 1 to NB	25°, 4mm	23°, 7mm	26°, 9mm	28°, 9mm
13.	IMPA	90°	84°	86°	88°
Soft tissue					
14.	Upper lip to E line	-4mm	-6mm	-4mm	-4.5mm
15.	Lower lip to E line	-2mm	+1mm	-1mm	-2mm
PA cephalogram					
16.	MSR to Menton (PA Cephalometric value)	0	+4.5mm to right	+2mm to right	+2mm to right

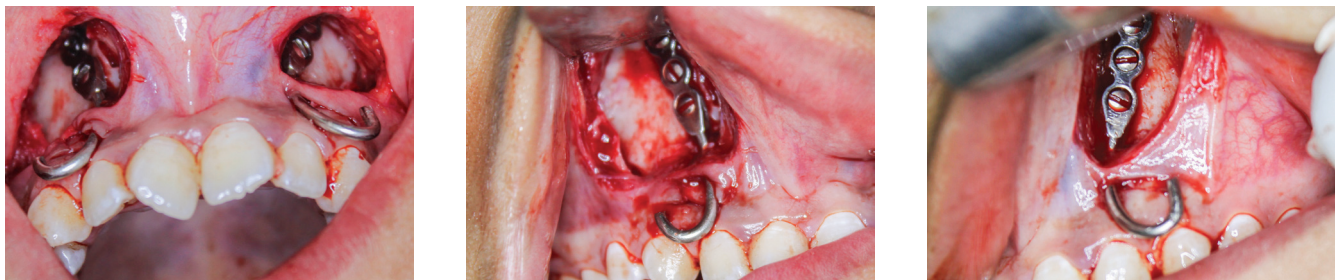


Figure 2 - Surgical miniplates in lateral nasal wall area.

to 14 ounces/side. Maxillary protraction was continued for 4 months until achievement of 4mm of positive overjet (Fig 4).

Facemask therapy was then continued for nighttime wear whilst full-fixed mechanotherapy was started. Maxillary and mandibular arches were aligned with series of light archwires (Fig 5). Spaces in maxillary arch were consolidated. Class II elastic on right side

and Class III elastics (5/16-in, 3.5 ounces) were used for correction of residual midline shift. Triangular settling elastics (1/8-in, 2 ounces) were used for final settling of occlusion.

Cephalometric analysis revealed significant changes (Table 1, post-treatment values) with significant improvement in soft tissue profile of the patient. The case was debonded after one year of full-fixed

mechanotherapy (Fig 6). In retention phase, reverse twin block was prescribed along with high-pull chin-cup. Four years after retention, the treatment results were maintained, with good soft tissue profile of the patient (Fig 7 and Table 1). Although mandibular dental midline did not coincide with the maxillary midline, the results showed significant improvement in Class III relation and mandibular asymmetry, with only minimal residual dental midline shift, which

was clinically acceptable. Stable molar relation with stable occlusion was achieved after treatment, and was maintained even after four years of retention. Mandibular asymmetry improved to a great extent and was within clinically acceptable range. Superimposition also showed significant improvement in skeletal malocclusion and soft tissue profile after treatment, and maintenance of treatment results after four years of retention (Fig 8).

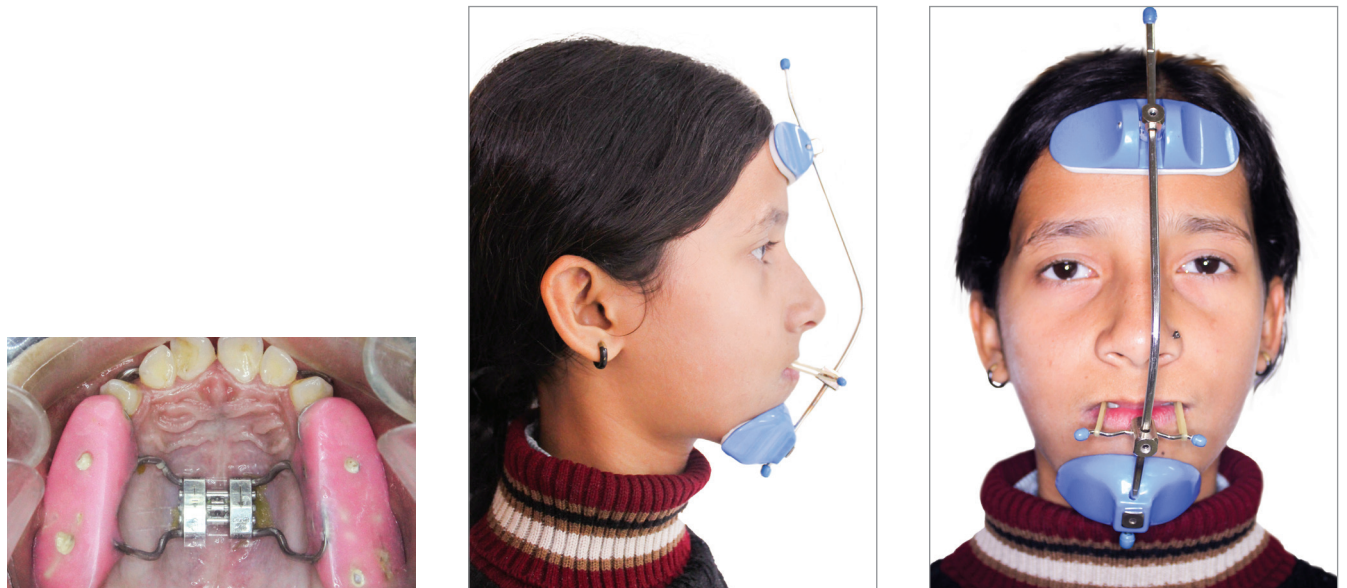


Figure 3 - Rapid maxillary expansion and Petit type facemask.



Figure 4 - After facemask therapy.

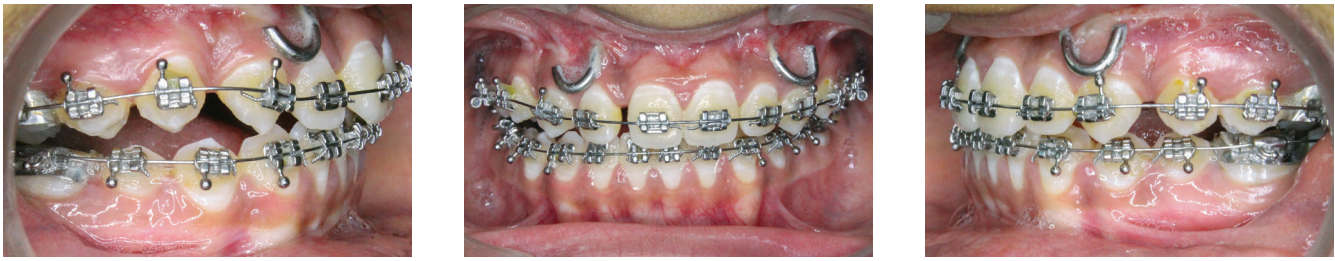


Figure 5 - Fixed mechanotherapy.



Figure 6 - Posttreatment photographs.



Figure 7 - Postretention photographs after 4 years.

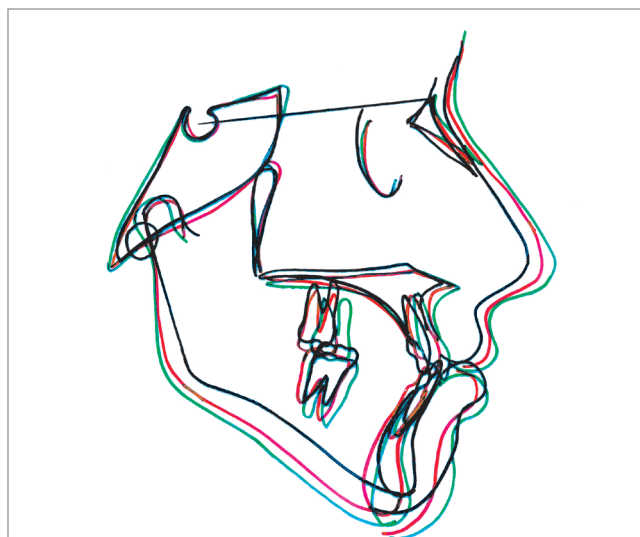


Figure 8 - Superimposition SN at S.

DISCUSSION

Facemask therapy results in skeletal and dentoalveolar changes. Skeletal changes include maxillary protrusive movement and downward and backward rotation of the mandible, with a decrease in mandibular prognathism. Such changes induce favorable changes in the facial profile. Dentoalveolar changes mainly consist of linguoversion of mandibular incisors and labial inclination of maxillary incisors.¹⁴ In conventional facemask therapy, the forces used for maxillary protraction are usually applied to maxillary teeth. Hence, undesirable side-effects such as anterior rotation of the maxilla, proclination of the maxillary incisors, excessive dental forward movement, and extrusion of the maxillary molars

due to indirect application of force are associated with conventional facemask therapy.¹⁵⁻¹⁷ These effects might camouflage the malocclusion and conflict with the main goals of the skeletal Class III treatment. To overcome these undesirable side-effects and achieve true maxillary protraction with direct force application to circum-maxillary sutures, it is desirable to use a protocol with rigid skeletal anchorage.

Additionally, one of the most important factors for successful maxillary protraction treatment is to determine the optimal timing to start treatment. Most studies suggest that protraction headgear therapy is more effective if implemented during the deciduous and early mixed dentitions.^{18,19} However, maxillary protraction with bone anchors has been reported to be successful in the late mixed or permanent dentition phases.²⁰ Since the patient was in CVMI transition stage, and in order to utilize the remaining growth potential at the most, with maximum skeletal effects, skeletally anchored facemask therapy was preferred.

The amount of maxillary protraction in Class III cases that are treated with skeletal anchorage might vary from 3.0 to 5.6mm.^{13,21-23} It can cause significantly larger maxillary advancement (2.3-3mm more), compared to the conventional facemask therapy.²⁰ It also results in fewer vertical changes. Furthermore, these patients do not exhibit clockwise rotation of the mandible or dental compensation.^{20,24} The upper lip and lip sulcus also move forward, and the soft tissue B point and pogonion move backward during the protraction period, indicating improvements in the soft tissue profile in line with the underlying skeletal components during the protraction procedure.²⁵⁻²⁷

Rapid maxillary expansion with a bonded appliance was performed. It is suggested that expansion appliance enhances the protraction effects in terms of time, with less dental and more skeletal effects. RME can disarticulate circum-maxillary sutures to facilitate the forward movement of the maxilla via facemask therapy and lead to downward and forward movement of A-point.^{28,29} RME also eliminated the causative factor for functional shift of mandible, i.e., constriction of maxilla, and resulted in improvement in mandibular asymmetry after expansion and protraction.

In the present case, miniplates were placed in the lateral nasal wall of the maxilla and orthopedic forces were applied directly to the intraoral extensions of

the miniplate. The lateral nasal wall area of the maxilla has an advantage of being anterior to the center of resistance of the nasomaxillary complex (the posterosuperior ridge of the pterygomaxillary fissure)³⁰, which allows resulting force vector close to the center of resistance and in line with the downward and forward growth of the maxilla.³¹ Furthermore, the lateral nasal wall of the maxilla is the most appropriate anatomic site for achieving the fullness of the nasobuccal folds, the infraorbital region, and consequently, the soft-tissue profile.^{13,32} In an animal model, Smalley et al.⁴ used osseointegrated implants to protract the maxillofacial complex, where greatest remodeling took place in the sutures and the bones closest to the force application point. Similarly, the present patient showed remarkable midfacial protraction and had positive improvement of her soft-tissue profile.


Asymmetry is one of the most difficult problems to correct in orthodontics. Synergistic effect of maxillary protraction and rapid maxillary expansion eliminated the occlusal interferences and resulted in correction of functional shift of mandible, improving the facial asymmetry. Remaining dental asymmetry was corrected by use of diagonal elastics.⁶

CONCLUSION

The use of skeletally anchored facemask therapy along with rapid maxillary expansion successfully managed the case of skeletal Class III with developing facial asymmetry in CVMI transition stage, which if not treated at this stage would have required a future more complex therapeutic approach, involving dental extractions and/or orthognathic surgery.

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Conception or design of the study: TT, SK. Data acquisition, analysis or interpretation: TT, SK, PR. Writing the article: TT, SK, PR. Critical revision of the article: TT, SK, PR. Final approval of the article: TT, SK, PR. Overall responsibility: TT, SK.

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