CASE REPORT

Face Mask Therapy and Comprehensive Orthodontic Treatment for Skeletal Class III Malocclusion: A Case Report

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Abstract

Aim: This article aims to report a case of face mask therapy and comprehensive orthodontic treatment for skeletal class III malocclusion in a 16-year-old girl.

Background: Treating skeletal class III malocclusion in a growing patient is crucial, as it can help avoid the need for additional surgery. Early treatment also lessens the negative impacts of the patient's facial abnormality on their social life because surgery is only done later.

Case description: In this case report, a 14-year-old female patient presented with skeletal class III malocclusion with primary complaints of anterior crossbite. There was no relevant medical history. Face mask therapy and fixed appliance therapy were components of the treatment approach that successfully corrected the malocclusion. The total period of treatment was 20 months.

Conclusion: The treatment resulted in a harmonious face, a well-aligned smile arch, stable dental and skeletal relationships, and significant esthetic improvements, including improved facial symmetry and profile.

Significance: A growing teen who has a skeletal class III malocclusion and a maxillary deficit may be helped by a combination of face mask therapy and thorough orthodontic treatment. This case report outlines the use of the aforementioned technique to successfully treat a 14-year-old child with class III malocclusion and maxillary deficiencies.

Early management of skeletal class III malocclusion in developing adolescents is vital as it can potentially eliminate the necessity for future surgical intervention, leading to improved treatment outcomes.

Careful case selection, patient cooperation, and long-term stability enable a successful, stable, and esthetically pleasing treatment outcome.

Keywords: Anterior crossbite, Case report, Face mask therapy, Maxillary deficiency, Posterior bite turbos, Skeletal class III malocclusion.

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Background

Class III malocclusions may occur due to skeletal or dental differences, resulting in both esthetic and functional deterioration.[1] The prevalence of class III malocclusions has been shown to exhibit significant variations across different ethnic groups.[2] Asian groups have a greater occurrence of class IIIs than Caucasians, with prevalence rates ranging from 4 to 13% in Japanese, 7.8 to 15.2% in Iranians, and 4 to 14% in Chinese.[3,4] A variety of causal factors are involved with conditions, including genetics and environmental factors. The function of genetic contribution and inheritance is significant, particularly in the case of mandibular prognathism.[5,6] Class III malocclusions are often detected early since they are one of the most common types of malocclusions and because skeletal development irregularities are already seen in class I malocclusions by the age of 4–5 years. Ellis and McNamara discovered that a backwardly positioned upper jaw, forwardly positioned upper front teeth, backwardly positioned lower front teeth, forwardly positioned mandibular, and an elongated lower face height were the most common features seen in people with a class III malocclusion. Moreover, maxillary insufficiency often represents around 60% of class III malocclusions.[7] Early treatment of class III malocclusions is critical due to their high prevalence as the primary reason for orthognathic surgery. This early intervention has the potential to significantly decrease or even eliminate the need for future treatments.[8] Nevertheless, it is well-recognized that class III skeletal malocclusions tends to recur after the completion of the first phase of therapy. Patients exhibiting significant mandibular prognathism need frequent monitoring and may require further face mask therapy.[9] For orthopedic growth modification to be deemed successful, it is necessary to carefully identify cases, provides therapy over an extended period, and ensure long-term follow-up. A class III malocclusion is characterized by the lower arch being more protruding than the higher arch, and the severity of this issue tends to increase as a person gets older.[10] Anterior crossbite occurs when the jaw is projected forward to overcome incisal restriction, resulting in a more functional occlusion. Protruding the mandible may be used to compensate for the interincisal angle and improve occlusion, leading to the development of an anterior crossbite.[11] Wu et al. conducted research that found that 75% of Chinese patients with skeletal class III malocclusions had a defective maxilla.[12] Additionally,

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research conducted by the Central Dental Hospital and the Institute of Dental and Maxillofacial Training in Vietnam reveals that skeletal class III malocclusion is the most prevalent kind of malocclusion, accounting for 41.7% of cases ($n = 15$).[13] Currently, the combination of face mask therapy and full orthodontic treatment is often used to address skeletal class III malocclusions. Its objective is to advance the maxilla or promote its development in that specific direction. In addition, when used with orthodontic therapy, maxillary expansion not only facilitates the horizontal development of the maxilla but also enhances vertical growth.[14] This case report outlines the use of the aforementioned technique to successfully treat a 14-year-old kid with class III malocclusion and maxillary deficiencies.

Case Description

Diagnosis and Etiology

A 14-year-old female patient came in for an orthodontic assessment due to an anterior crossbite and both dental and skeletal class III malocclusion. There were no previous records of any systemic illnesses or injuries to the face. The frontal view showed that the lower face height was longer, and the upper lip was retracted and flat. The smile arc exhibited significant facial asymmetry. The midline of the upper and lower coincide with the midline of the face. Prognathic lower incisors, retrognathic maxilla, and prognathic mandible were her dental characteristics. Furthermore, there is an unbalanced mandibular arch, a symmetrical maxillary arch, and a link between both canines and molars in class III malocclusion (Fig. 1). Space analysis conducted with a digital caliper revealed the presence of mild crowding in the upper arch (Fig. 2).

The analysis of lateral cephalometric radiography and its tracing showed that according to Vietnamese norms, the patient had a skeletal class III malocclusion (SNA: 84.82°, SNB: 88.91°, and ANB: −4.09°) that was confirmed by Wits appraisal: −2.67 mm, facial axis: 87.49°, mandibular plane angle (Go-Gn to SN): 28.94°, overbite: 0.57 mm, overjet: −0.63 mm, U1 to FH: 107.79°, U1 to NA: 1.28 mm, interincisal angle: 135.2°, L1 to A-Pog: 2.15 mm, L1 to mandibular plane angle: 89.19°, and upper molar to PtV: 6.87 mm. Furthermore, she had an acute nasolabial angle and retrusion upper, normal lower lip (nasolabial angle: 86.56°, lower lip to E-plane: 1.15 mm, and upper lip to E-plane: −0.72 mm) (Table 1).

The radiograph showed that the condyles were symmetrical. The temporomandibular joint, maxillary sinus, bone level, tooth morphology, and absence of bony diseases were all within normal ranges. The maxillary and mandibular third molars were in the process of eruption. There was the composite filling of the first molar on the right of the mandibular (Fig. 3).

Treatment Objectives

The objective of the treatment was to attain angle class I molar and class I canine connections, together with a proper overbite and overjet, as well as aligned midlines. This was achieved by the stimulation of maxillary development and redirection of mandibular growth, together with the correction of anterior and posterior crossbites.[15]

Delaying fixed-appliance treatment until the growth spurt stopped was an alternative to early treatment. However, extractions and camouflage treatment would have been necessary for this method to be successful. In contrast, early protraction face mask therapy has the potential to lessen the skeletal difference, which in turn might make orthodontic treatment easier and less likely to

Fig. 1: The facial and intraoral photographs of pretreatment for a 14-year-old female

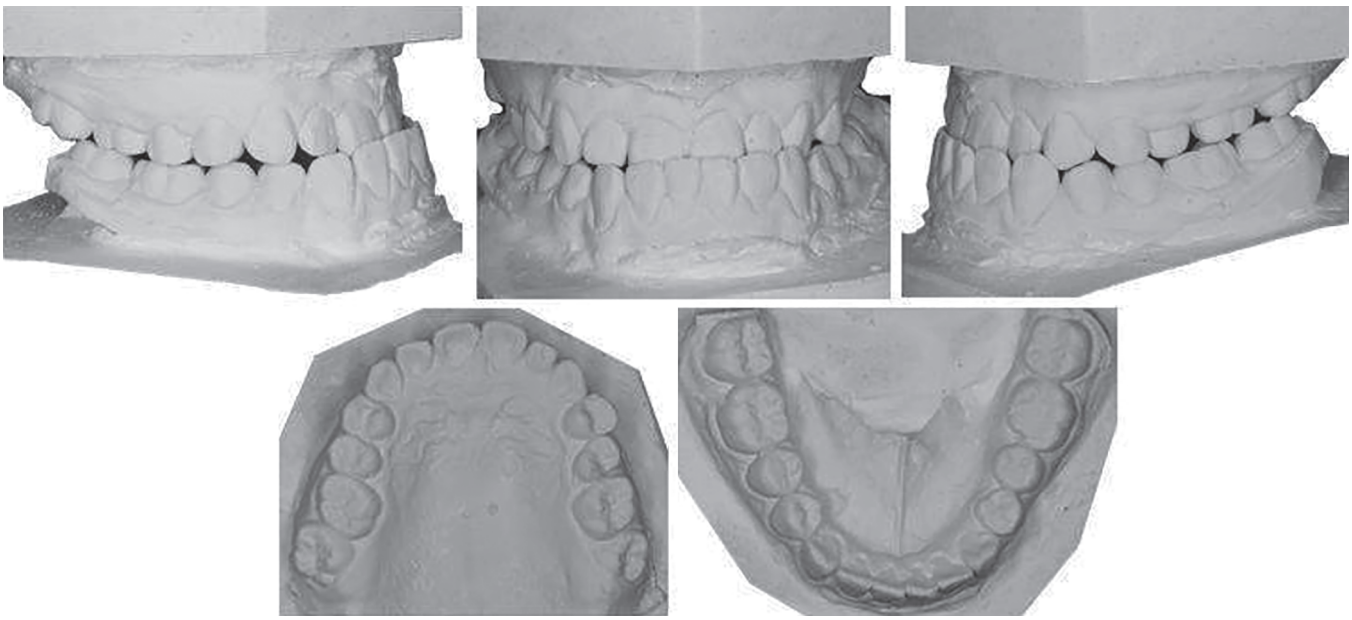

Fig. 2: The study models (casts) of pretreatment

Table 1: Cephalometric analysis of pretreatment and posttreatment

Measurements	*Norm (standard deviation)*	*Initial*	*Posttreatment*
SNA	81.08 (3.7)	84.82	85.1
SNB	79.17 (3.8)	88.91	84.14
ANB	2.46 (1.8)	–4.09	0.96
Wits appraisal	–0.33 (2.7)	–2.67	1.51
Facial axis	88.1 (2)	87.49	94.4
Y-axis	59 (6)	61.34	57.28
Lower anterior face height	65 (5)	27.24	25.38
Mandibular plane angle (Go-Gn to SN)	32 (4)	28.94	20.93
Facial angle	87.8 (3.5)	87.27	92.35
A-B to mandibular plane	69.3 (2.5)	66.62	63.25
ANS-Xi-Pm	47 (4)	46.08	40.81
Overbite	2 (2)	0.57	0.17
Overjet	2 (2)	–0.63	1.26
U1 to FH	113.8 (6.4)	107.79	127.54
U1 to NA (mm)	4 (3)	1.28	3.68
Interincisal angle	128 (5.3)	135.2	131.22
L1 to A-Pog (mm)	1 (2)	2.15	0.97
L1 to mandibular plane angle	92 (5)	89.19	81.91
Upper molar to PtV	21.1 (3)	6.87	7.92
Nasolabial angle	95 (5)	86.56	76.99
Lower lip to E-plane	0 (2)	1.15	–0.33
Upper lip to E-plane	0 (2)	–0.72	–1.61

SNA, sagittal position of maxilla (°); SNB, sagittal position of mandible (°); ANB, maxillary/mandibular relation (°); ANS-XI-Pm, Angle formed by center of the ramus point (Xi) and line Xi-anterior nasal spine (ANS) and Xi-suprapogonion (Pm); U1 to FH, angle between the axis of the upper incisor and FH line; U1 to NA, the distance between the tip of the upper incisor (U1) and a line from nasion to point A; L1 to A-Pog, distance from lower incisor edge to A-Pog line

result in relapse. The patient's age made it reasonable to anticipate cooperative behavior. One of the treatment's main objectives was to correct the deficiency in midfacial and lower facial height. Additionally, it was crucial to keep the patient's vertical dimension in control, as well as to correct overbite, overjet, and crossbites. Moreover, class I canine and molar classification should be maintained bilaterally. Finally, it established functional occlusion and improved facial contours, lip posture, and smile arc.

Treatment Plan

- Plan A: Camouflage treatment was directed at correction of the occlusion and masking the skeletal discrepancy—(1) asymmetric

extraction for midline correction—UR5, UL5, LL4, and LR4; (2) buccal shelf bone screws and class III elastics for retracting the mandibular arch; and (3) counseling, exercises, and lingual spurs to correct interincisal tongue posture. These mechanics were designed to produce an optimal class I occlusion and midline correction and improve the concave facial profile. However, the patient's face was still concave.

- Plan B: Orthognathic surgery was often the preferred approach to correct the skeletal component of a class III malocclusion with an open bite. However, the patient and her parents refused orthognathic surgery, which was previously suggested by multiple orthodontists.
- Plan C: Use the orthodontic face mask appliance to stimulate the growth of the maxillary skeletal. Class III elastics were applied to the canine and molar into class I.

Thus, camouflage treatment (plan C) was the family choice.

Treatment Alternatives

Postponing fixed-appliance therapy until after the period was over was an option to begin therapy early. That approach, however, would have required camouflage treatment and extractions. Early protraction face mask therapy, on the contrary, has the potential to successfully minimize skeletal disparities, simplifying orthodontic treatment and reducing the risk of recurrence.

Treatment Progress

A 0.022 in slot 3M™ SmartClip™ SL3 Self-Ligating Brackets was selected. All archwires and auxiliaries were supplied by the same manufacturer. The initial mechanics for both arches were 0.014 in CuNiTi archwires fitted with resin balls bonded on the ends to prevent mucosal irritation. At the same appointment, a face mask and posterior bite turbos were constructed. After 6 months, the anterior crossbite teeth area was resolved (Fig. 4).

Fig. 3: The lateral cephalogram, panoramic radiograph of pretreatment

Fig. 4: After 6-month treatment

In the 8th month, both archwires were changed to 0.014 × 0.025 in nikel titanium (NiTi). Class III elastics (Quail, 3/16in, 2oz; Ormco) were used bilaterally from upper first molars (U6s) to lower canines (L3s) for 5 months to achieve a class I molar relationship. At the same time, box elastics (Fox, 1/4in, 3.5oz; Ormco) from upper right first premolar (UR4), upper right second premolar (UR5) to lower right second premolar (LR5), and lower right first molar (LR6) were used to correct. At 10 months, we removed discontinuing protraction; both archwires were changed to 0.016 × 0.022 in stainless steel (SS). In the 18th month, the leveling and alignment were completed (Fig. 5). Both archwires were changed to 0.017 × 0.022 in SS.

The permanent appliances were removed after 20 months of treatment, and fixed retainers were bonded to the lingual surfaces of the mandibular arch from canine to canine (Fig. 6). The Hawley appliance came with upper retainers.

Results Achieved

Facial esthetics and the anterior crossbite were significantly improved after 20 months of orthodontics treatment (Fig. 7). The molar and canine relationships were corrected to class I (Fig. 8). The posttreatment panoramic radiograph documented acceptable root parallelism (Fig. 9). The superimposed cephalometric tracing showed proclined maxillary incisors as a result of anterior crossbite correction (Fig. 10). The axial inclination of the upper incisors (U1-FH) increased 21° after treatment (107.79°–127.54°), and the axial inclination of the lower incisors (L1-MP) was decreased (89.19°–81.91°) (Table 1). The lower lip was retruded following the

Fig. 5: In the 18th month, the leveling and alignment was completed

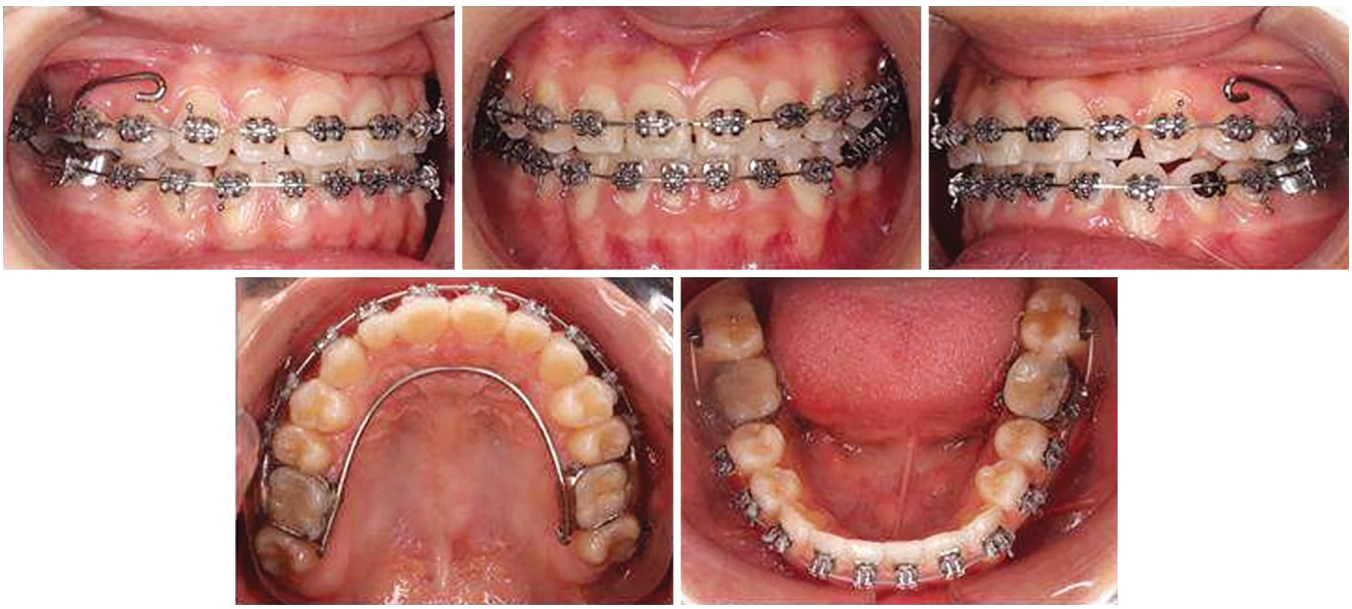

Fig. 6: Before fixed appliances were removed

retraction of the anterior segments. The mandibular plane angle (SN-MP) was well maintained (Table 1). The patient was satisfied with the end consequence. Without orthognathic surgery, the treatment was completed in only 20 months.

Retention

A fixed retainer was positioned on the lingual surfaces from LR4 to LL4 to stop crowding from reoccurring. For the 1st month, the patient was told to wear the Hawley retainers full-time and only to sleep in them thereafter.

Discussion

Successful treatment of early skeletal class III malocclusion may be achieved by meticulous diagnosis and diligent implementation of a treatment plan.[16] In treating skeletal class III malocclusion, it is crucial that you carefully evaluate the timing of treatment. Growth is an ongoing phenomenon, and unfavorable growth tends to go in the correct direction, resulting in desirable consequences. Hence, the timing of intervention is crucial and remains a highly debated topic. Early intervention has many benefits, including improved patient compliance, greater quality of life, psychological advantages, prevention of unfavorable development reversal, and effective maxillary extension.

Nevertheless, two significant drawbacks are an extended period of retention and a higher likelihood of recurrence caused by the development of the mandibular bone. Delayed therapy offers advantages, such as capitalizing on advancements in pubertal development, heightened secretion of growth hormone, and addressing physiological challenges associated with bodily transformations. Nevertheless, in some instances, class III malocclusion symptoms may escalate in severity if not addressed promptly. The increasing number of patients requiring treatment throughout their growth period will inevitably compel us to specialize in orthopedic surgery and orthodontic concealment. Consequently, there exist various perspectives on the optimal length of therapy for class III malocclusion caused by bone issues. The arguments about the early and late correction of class III malocclusion are significant in the literature. The kinds of teeth are among the things that must be taken into account while managing this illness. Currently, there is a lack of data on the duration of therapy for class III malocclusion, specifically when considering different tooth kinds.

Orthodontists have extensively discussed the effectiveness of early intervention in treating malocclusions, such as using

Fig. 7: The facial and intraoral photographs of posttreatment

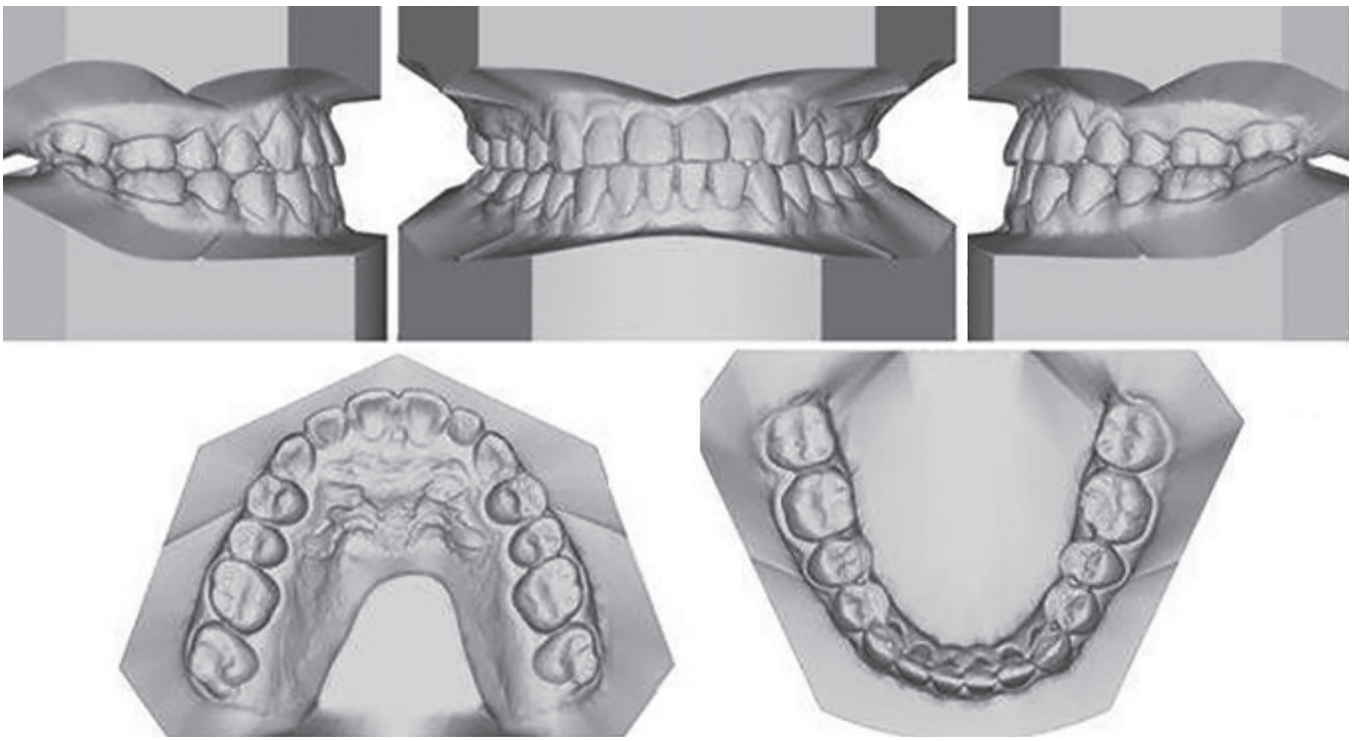

Fig. 8: The study models (casts) of posttreatment

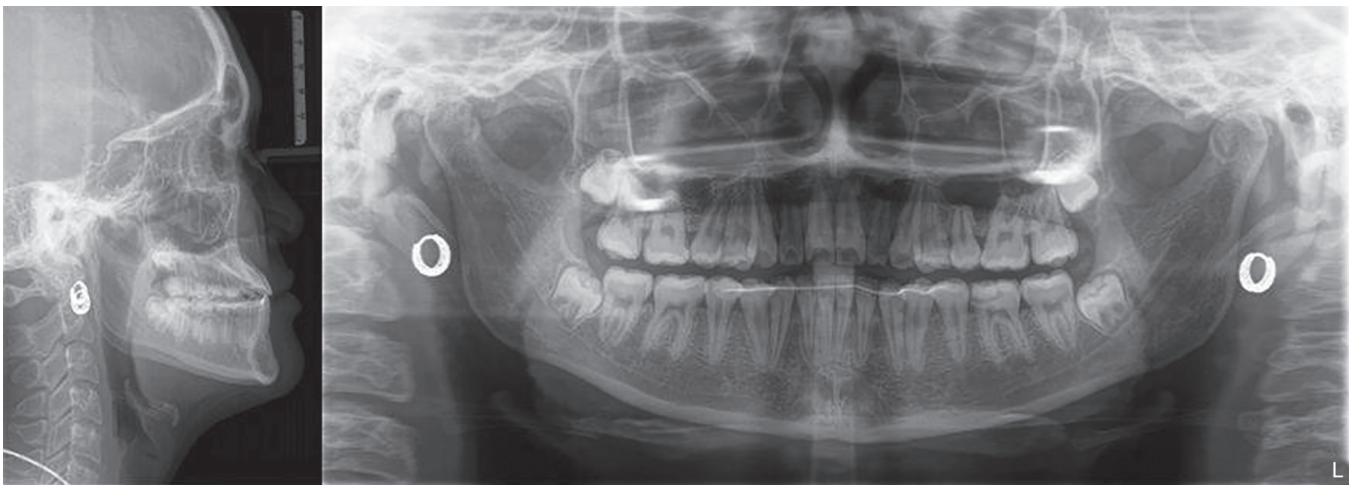

Fig. 9: The lateral cephalogram, panoramic radiograph of posttreatment

functional appliances or correcting crossbites caused by displacement of the lower jaw. However, the current body of data supporting these interventions is largely lacking in strength.[17] The efficacy of treating skeletal class III malocclusion in primary and mixed dentition patients, as well as the timing of permanent tooth eruption, can be achieved through the use of various appliances, such as reverse twin block, face mask, Frankel III, tandem traction bow appliance (TTBA), chin cup, and bone-anchored maxillary protraction. The efficacy of orthognathic expansion and orthodontic face mask therapy in the early management of skeletal class III malocclusion. During the course of 18 months, we detected changes in the skeletal structure. To ensure long-term stability, we intentionally corrected the overjet and molar relationship beyond the desired level.[18,19] The fundamental issue is the difference in growth between the mandible and the maxilla, which may be responsible for the recurrence of class III malocclusions. Some authors have found an increase in vertical dimension using face mask treatment, which may be decreased by stretching the skeletal anchor wall instead of employing a palatal expander with hooks.[20–23]

The original treatment approach focused on rectifying the maxillomandibular discrepancy by using a face mask, followed by a fast extension of the maxilla. This expansion also played a role in addressing transverse insufficiency.[24] In this case, we combined orthodontic face mask treatment and fixed appliances with brackets combined with class III elastics to reduce two treatment stages and maximize treatment effectiveness.

To illustrate the results, we utilized a modified appliance that was constructed in the style of a TTBA. Moments later, therapy involving a miniature face mask commenced. For 6–8 months,

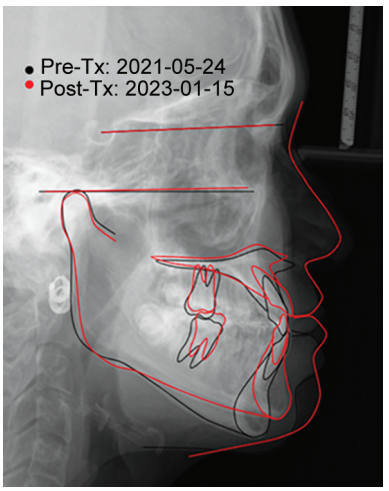

Fig. 10: The pretreatment class III molar relationship was shown by superimposing cephalometric tracings (black, pretreatment; red, posttreatment); as a consequence of anterior crossbite correction, proclined maxillary incisors were inevitably revealed, which were easily accessible

600 g of force was administered 14 hours/day to overcorrect an anterior crossbite. Nevertheless, the patient disclosed that they exerted force for a duration of 12 hours daily; as a consequence, the correction of the anterior crossbite required 6 months. She was subsequently instructed to sleep with the appliance in place for 4 months to attain protraction stability.

Posterior bite turbos, designed to help correct bite problems, can be placed on the back parts of either arch. Posterior bite turbos help to solve anterior crossbites while increasing vertical dimension in some cases of closed jaw angle. By following a well-designed protocol for posterior bite turbos placement and use, orthodontic professionals can help patients improve oral function and esthetics while minimizing the risk of complications and other adverse outcomes.

Adding daytime class III elastics improves the sagittal maxillary-mandibular relationship, increases skeletal effects, such as maxillary protraction and backward rotation of the mandible, and decreases dental effects, such as retroclination of the lower incisors. Additionally, daytime class III elastics enhance soft tissue response in the form of forward movement of the upper lip.[25] Class III elastics were found to induce substantial displacement of maxillofacial structures and sutures during correction of skeletal class III with maxillary retrognathism.[26] In this case, we use the classic design of class III elastic traction. The classic design of class III elastic traction starts from the lower canine and goes to the first upper molar. This force direction causes forward movement of the upper teeth and backward movement of the lower teeth. In the maxillary arch, move the posterior teeth forward to close the space and/or tilt the maxillary incisors with medial displacement of the entire arch. The classic design can be modified to produce the desired force composition. It may go to the upper second molar because a more horizontal force component is required.[27]

Conclusion

The efficacy of combining face mask therapy with comprehensive orthodontic treatment in the management of skeletal class III malocclusion accompanied by maxillary deficiency in a developing child was illustrated in this case study. Thus, long-term stability, efficacy, and esthetic appeal are guaranteed through meticulous case selection, patient cooperation, and successful treatment outcomes.

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