Case Report

Orthodontic Treatment for Borderline Class III Malocclusion in Adults: Nonextraction Treatment with Anterior Bite Turbo: A Case Report

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Received : 26-Nov-2023
Revised : 23-Jan-2024
Accepted : 25-Jan-2024
Published : 27-Feb-2024

ABSTRACT

Retrusive upper lips, retroclined upper incisors, a shorter midface, and a larger maxillary–mandibular difference are the characteristics of borderline Class III malocclusion. Individuals with borderline Class III malocclusion frequently exhibit certain morphologic, dental, and skeletal traits, which should aid in the diagnosis of the condition. To report the case of a 22-year-old Vietnamese woman who complained of having tense front teeth and lacking confidence when smiling. Medical history did not find anything strange, there was root canal treatment of the first premolar on the left of the upper jaw, asymmetrical concave chin, and right deviation. Orthodontic camouflage treatment using anterior bite turbos in combination with early light short Class III elastics and box elastics was proposed since the patient declined to have orthognathic surgery. In just 10 months of treatment, a Class I molar and canine relationship was created, an anterior crossbite was corrected via mandibular retraction, and severe skeletal malocclusions were successfully treated without orthognathic surgery. Smiling currently showcases the patient's maxillary incisors more prominently, and her lower lip fullness has diminished, giving her a more attractive smile and a significant improvement to her facial profile.

KEYWORDS: *Anterior bite turbo, borderline Class III, case report, nonextraction, orthodontic treatment*

INTRODUCTION

Malocclusion is an occurrence of biological variability, that is, normal. This is a continuum in which the optimum occlusion is followed by challenging circumstances from the norm.[1] Ethnic groups have been shown to differ significantly in the proportion of Class III malocclusion.[2] Compared with Caucasians, Asian populations have a higher frequency of Class III.[1] There are mainly three types of Class III malocclusions: skeletal, dental, and pseudo. Class III malocclusions were first divided into two categories by Tweed: Class III pseudo or skeletal.[3,4] A pseudo-Class III malocclusion is frequently detected by the following indications: (1) no history of prognathism in the patient's family; (2) the mandible is forward in centric occlusion; (3) the patient is guided into a centric relation in an end-to-end incisor relationship; (4) the midface length is decreased; (5) the mandibular length is normal; (6) the lower incisors are normal and the upper incisors are retroclined; and (7) the upper lip is persistent.[5] Deciduous or mixed dentitions are also the main conditions in which these malocclusions develop.[6] Furthermore, maxillary insufficiency contributes to approximately 60% of Class III malocclusions.[7] For skeletal class III malocclusion,

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Access this article online

Quick Response Code:

Website: https://journals.lww.com/jpcd

DOI: 10.4103/jispcd.jispcd_190_23

How to cite this article: Le LN, Do TT, Le KVP. Orthodontic treatment for borderline Class III malocclusion in adults: Nonextraction treatment with anterior bite turbo: A case report. J Int Soc Prevent Communit Dent 2024;14:78-87.

the three primary treatment options are orthognathic surgery, dentoalveolar compensation (also known as orthodontic camouflage), and growth modification. Growth modification should begin before the pubertal development phase because there are only two further operations available following this time. In these cases, how do doctors determine if a patient is a good surgical candidate? Since Class III malocclusions are the most common problem needing orthognathic surgery, it is crucial to address this disparity early on to minimize or even prevent the need for further procedures.[7] Individuals who have been diagnosed with an Orthognathic Functional Treatment Need (IOFTN) are the ones who should have orthodontic surgery the most.[8] This case was 4.3 of IOFTN with functional difficulties, a borderline case that can be handled surgically as well as orthodontically, however, the patient did not like the procedure. As an alternative, orthodontics with an anterior turbo bite is used in this case study. The retroclination of the maxillary incisors causes occlusal interference, which results in the protrusive shift. In essence, the mandible's forward posture emphasizes a skeletal discrepancy.[4] Through the incorporation of the functional turbo into the mandibular central incisors, which have occluding surfaces that are beveled to guide opposing teeth into the proper positions. Protrusive displacement of the jaw and anterior crossbite was rapidly reduced as the maxillary central incisors were driven forward by the pressure of the inclined plane of the turbo. The mandible's ability to spin clockwise in an opening action was made possible by the functioning anterior turbo bite, which helped in the malocclusion's correction.[9]

Diagnosis and Etiology

A 22-year-old Vietnamese female patient complained of tension in her incisor teeth and a lack of confidence when smiling. There was a root canal treatment on the upper left first premolar, an asymmetrical concave chin, and a right deviation in the medical history, but nothing unusual.

Several features were noted during the extraoral examination; they included a concave profile, symmetrical thick lips, an acute nasolabial angle, and a relatively flat labiomental fold. The frontal perspective brought attention to the dolichofacial face shape, which is characterized by an increased lower facial third, a regular nose size, and a little deviation to the right. The typical length and shape of the patient's lips rendered them useless. When the patient smiled, her lips looked normal, and her incisors were visible without gingival presentation; this indicated that the patient did not have an occlusal cant. Her lip morphology and length were ordinary, and her upper midline was 1 mm to the right of her face midline. The patient's ethnic coloring was modest, and the intraoral dental health was excellent. This patient had a full complement of canine and angle Class I molar relationships. The proclines and protrusions of the lower incisors exacerbate the malocclusion. She was a little crowded in the lower arch [Figures 1, 2].

The upper and lower casts both had U-shaped arch forms. There was an inconsistent maxillary arch in the transverse and anteroposterior planes due to interferences from the buccally positioned incisors (UR1 and UR2) and the crossbite incisor (UR3), and dental castings showed a restriction in the upper right posterior segment that was related to the upper left segment. As a consequence, the upper left section took the position formerly held by the upper right segment. In addition, since the LR3 was positioned mesiolabially, the anterior region of the mandibular arch exhibited an aberrant arch shape in both the transverse and anteroposterior directions. On UR1, UR2, and UR3, the patient displayed mesiolabial rotation. In LR1, she underwent her mesiolingual rotation as well. The transverse and anteroposterior arch shapes of the mandibular arch's anterior part

Figure 1: Facial photographs of pre-treatment, 22-year-old female

Figure 2: Intraoral photographs of pre-treatment

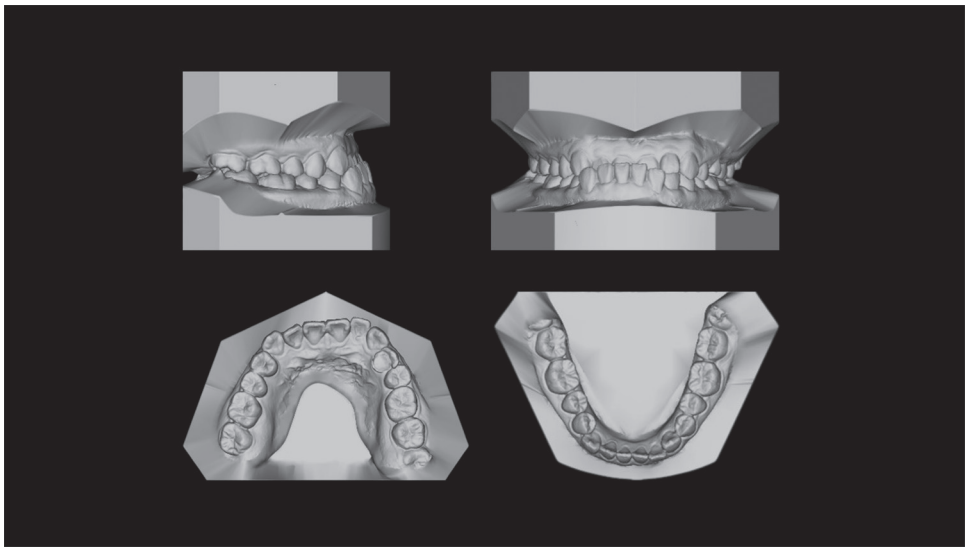

Figure 3: Study models (casts) of pre-treatment

were aberrant because of the mesiolabic rotation of the LR3. Mesiolabial rotation is seen in UR3, UR1, and UR2 for this patient. Additionally, she completed LR1's mesiolingual segment. Digital space analysis showed that the lower arch was a little crowded and the upper arch was moderately crowded, with a crowding of 3.6 mm [Figure 3].

Using the following parameters: SNA: 79.63°, SNB: 84.35°, and ANB: −4.72°, the patient's skeleton was determined to be Class III according to Vietnamese norms by Wits analysis. The examination and follow-up of lateral cephalometric photographs verified this: −3.81 mm. At 25.24°, both the inferior anterior surface and the mandibular plane (from Go-Gn to SN) were at an angle of 25°. This suggested a hypothesized divergence. From the lower incisors to the nasal root point B (L1-NB): 8.3 mm, and from the lower incisors to the mental point A (L1-Apo): 8.4 mm, the overjet: −0.38 mm, the overbite: 1.45 mm, the angle from U1 to FH: 113.06°, the angle from U1 to NA: 2.76 mm, and the Interincisal angle: 139.61°, as shown by the angular and linear measurements. With a nasolabial angle of 71.11°, a lower lip to E-plane measurement of 0.17 mm, and an upper lip to E-plane measurement of −1.27 mm, she additionally displayed normal upper lip retrusion and a normal lower lip [Table 1]. Condyles were more symmetrical, as seen by the panoramic radiograph. There were no skeletal diseases, and the teeth, bone level, temporomandibular joint, and maxillary sinus were all normal. The first premolar on the left side of the

Table 1: Cephalometric analysis of pretreatment and posttreatment

Measurements	Norm (SD)	Initial	Posttreatment
SNA	81.08 (3.7)	79.63	80.85
SNB	79.17 (3.8)	84.35	82.58
ANB	2.46 (1.8)	−4.72	−1.73
Wits appraisal	-0.33 (2.7)	-3.81	-2.2
Facial axis	88.1 (2)	92.16	90.78
Y-axis	59 (6)	57.73	58.84
Lower anterior face height	65 (5)	25.24	26.09
Mandibular plane angle (Go-Gn to SN)	32 (4)	25.03	27.26
Facial angle	87.8 (3.5)	89.72	89.23
A-B to mandibular plane	69.3 (2.5)	62.68	66.6
ANS-Xi-Pm	47 (4)	40.14	42.53
Overbite	2 (2)	1.45	0.18
Overjet	2 (2)	-0.38	1.22
U1 to FH	113.8 (6.4)	113.06	122.28
U1 to NA (mm)	4 (3)	2.76	3.39
Interincisal angle	128 (5.3)	139.61	126.68
L1 to A-Pog (mm)	1 (2)	1.6	1.26
L1 to mandibular plane angle	92 (5)	85.96	88.17
Upper molar to PtV	21.1(3)	4.18	6.2
Nasolabial angle	95 (5)	71.11	65.79
Lower lip to E-plane	0 (2)	0.17	−0.18
Upper lip to E-plane	0 (2)	−1.27	−1.66

Figure 4: Lateral cephalogram, panoramic radiograph of pre-treatment

maxilla received a composite filling and performed root canal treatment. Both third molars in the upper mandible erupt [Figure 4].

Treatment Objectives

Orthodontic treatment included treatment of the patient's main orthodontic issue, a crossbite in the front teeth. One of the goals was to learn how to effectively seal individual lips, and another was to achieve a balanced facial profile. The individual's vertical dimension additionally had to be controlled. Additional important goals include changing the dental midline, correcting asymmetries in the dental arches, resolving the Bolton disparity, minimizing dental crowding in the upper quadrants, and maintaining a bilateral Class I canine classification. Finally, to achieve a well-defined curvature of the smile, it is important to establish a functional alignment of the teeth in optimum contact, as well as a canine-guided occlusal scheme that ensures the safety of the teeth without any challenges.

Treatment Plan

The plan for this camouflage treatment was to resolve the Class III relationship by retracting the lower arch and correcting the anterior crossbite. Anterior bite turbos were planned to assist with the correction, and early light short triangle Class III box elastics would rectify the molar relationships.

Treatment Alternatives

The four premolars can be extracted as a possible solution to the anterior crossbite and crowding. This option's drawbacks include a concave face profile and

a shorter duration for crowding relief. The patient, however, selected a nonextraction alternative.

Treatment Progress

3M Unitek® (Monrovia, CA, USA) US Victory Series 0.022″ Slot Fixed Appliance Brackets (MBT −0.022 Slot) were selected along with all specified archwires and orthodontic appliances. The 0.022″ Victory Series sockets were bonded to the lower teeth using 0.014″ Cu–NiTi arches. Standard torque was selected for the bracket. In the same appointment, anterior occlusal turbines were constructed with flowable resin at LR2, LR1, and LL1 to open the premaxillary space and perform anterior crossbite correction after aligning the lower incisors [Figure 5]. For correction of anterior crossbite, lightweight short triangular Class III elastics (Quail, 3/16″, 2-oz; Ormco, Brea, CA, USA) were used early for 2 months. At the same time, box elastics (Fox, 1/4″, 3.5-oz; Ormco) were used on both sides from U4.5 to L4.5 for correction. In the third month of treatment, the overbite and overbite were significantly improved and the occlusal turbine was removed [Figure 6]. In the fifth month, both archwires were changed to 0.014″ × 0.025″ NiTi. Class III elastics (Quail, 3/16-in, 2-oz; Ormco) were used bilaterally from U6 to L3 for 3 months to achieve a Class I molar relationship.

At the same time, box elastics (Fox, 1/4″, 3.5-oz; Ormco) from UR4, UR5 to LR5, and LR6 were used to correct. In the eighth month, the spaces were closed and the leveling and alignment were completed. Both archwires were changed to 0.016×0.025 in stainless steel [Figure 7]. After 10 months of active treatment, all fixed appliances were removed, and fixed retainers were bonded on the lingual surfaces from canine to canine in the mandibular arch [Figures 8, 9]. Upper retainers were delivered with the Hawley appliance.

Figure 5: Anterior bite turbo (flowable resin) was bonded on the LR2, LR1, and LL1 to open the bite. Early light short triangle Class III elastics (Quail, 3/16-in, 2-oz; Ormco), box elastics (Fox, 1/4″, 3.5-oz; Ormco) from UR4, UR5 to LR5, and LR6 were used to correct the anterior crossbite

Figure 6: After 3 months of treatment—remove the anterior bite turbo

Figure 7: The 5-month treatment comprised of using box elastics (Fox, 1/4″, 3.5-oz; Ormco) and light short triangle elastics (Quail, 3/16″, 2-oz; Ormco)

Figure 8: Before fixed appliances were removed

Figure 9: Intraoral photographs of posttreatment

Figure 10: Extraoral photographs posttreatment

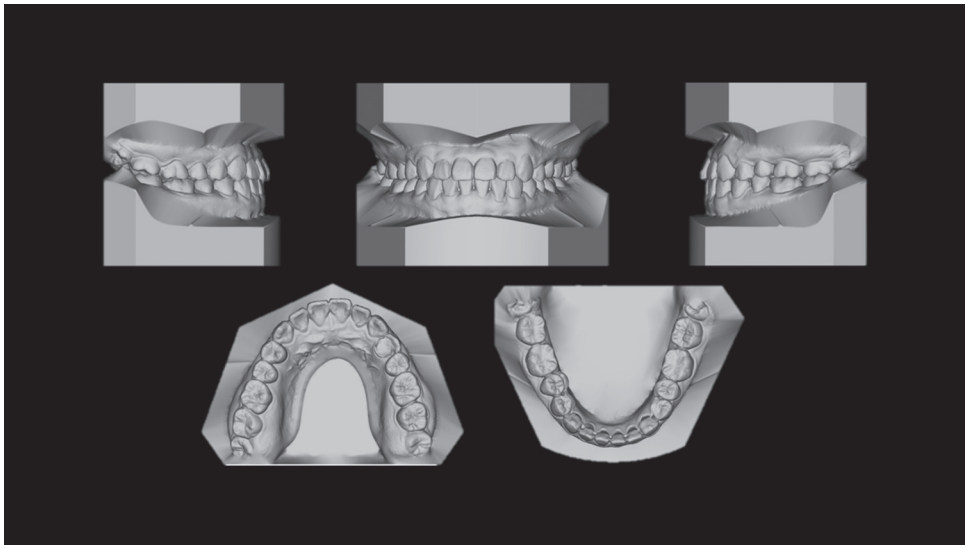

Figure 11: Study models (casts) of posttreatment

Results Achieved

After 10 months of active treatment, facial esthetics, and the anterior crossbite dramatically improved [Figures 10–12]. To Class I, the molar relationships were corrected. Good root parallelism was shown on the posttreatment panoramic radiograph [Figures 10, 11]. The anterior crossbite correction was seen in the proclined maxillary incisors (3.3 mm) on the displayed cephalometric trace [Figure 13]. The axial inclination of the upper incisors (U1-FH) increased 7° after treatment (113.06°– 122.28°), and the axial inclination of the lower incisors (L1-MP) was maintained (86°–88°) [Table 1]. The lower lip was retruded following the retraction of the anterior segments. The mandibular plane angle (SN-MP) was well maintained [Table 1]. The patient was satisfied with the outcome in the end.

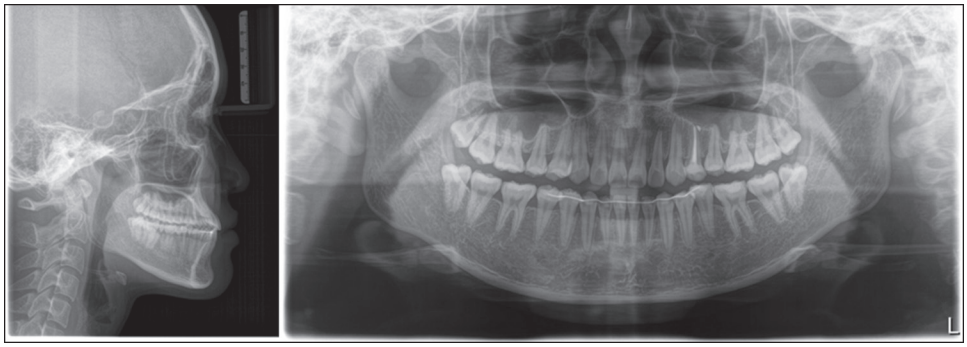

Figure 12: Lateral cephalogram, panoramic radiograph of post-treatment

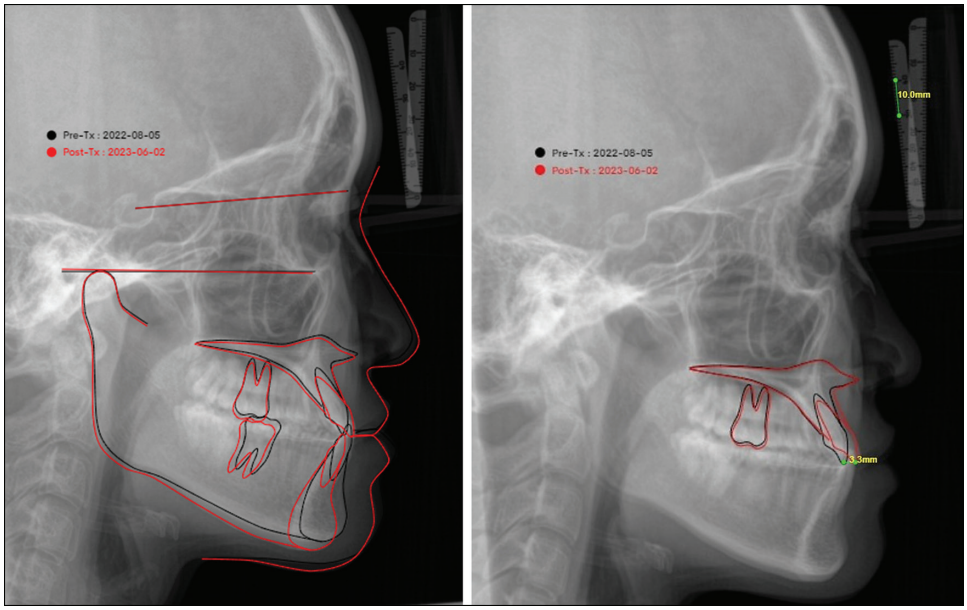

Figure 13: Superimposed cephalometric tracings (black: pretreatment; red: posttreatment) show the pre-treatment Class I molar relationship. Inevitable showed proclined maxillary incisors (3.3 mm) as a result of anterior crossbite correction; it is well-acceptable

In just 10 months, the treatment was finished without the need for orthognathic surgery.

Retention

A fixed retainer was positioned on the lingual surfaces from LR2 to LL2 to stop crowding from happening again. The Hawley retainers for the upper were to be worn continuously for the first month, then just when sleeping, according to the patient's instructions.

Discussion

Until recently, adult patients with minor skeletal discrepancies were often managed without orthognathic surgery.[10,11] The available treatment options included stripping, tooth extraction, headgear, and the use of Class III elastics alone or in combination with a sliding jig.[11,12] For orthodontists, camouflage treatment presents many difficulties when treating Class III malocclusions. To achieve good non-surgical results, orthodontists require a definitive diagnosis and a suitable treatment plan profile.[13-15] Most patients with borderline Class III malocclusion could perform a functional shift and have orthognathic facial profiles in centric relation (CR), even if their ANB angles exceed –2°. These patients tend to respond favorably to dentoalveolar treatment. Classification A positive prognostic indicator for conservative treatment is to check if the patient could achieve Class I occlusion in CR.

Class III malocclusion may have an environmental or genetic etiology. Incisal interference can result from retroclination or proclination of the maxillary or mandibular incisors. In the case of skeletal Class III malocclusion, this interference may cause the mandible to position anteriorly. The term used to describe this condition is pseudo-Class III malocclusion. Regrettably, a cephalometric examination might not provide the most precise indication as to whether

skeletal disharmony originates from the mandible or the maxilla. Dental characteristics that are frequently observed encompass anterior crossbite or edge-to-edge occlusion, canines and molars of Angle Class III, and retroclined mandibular incisors. Treatment of Class III malocclusion at an early stage may reduce the extent of limitations and adaptations that are frequently observed in late adolescent cases of severe malocclusion. Nonetheless, treating skeletal crossbites remains to be a challenging task for the profession. Currently, it is not possible to accurately estimate an individual's growth because of the diversity and unpredictability of face growth. Mandibular-focused therapy appears to encourage relapse throughout the pubertal development stage. Promising outcomes are shown in maxilla treatment, which is awaited for long-term clinical outcomes after early orthopedic procedures. Dental crossbites have been successfully eliminated by several intraoral appliances.[16]

To correct the anterior crossbite, the flowable resin was used to create anterior inclined bite turbos, which created an opening in the intermaxillary space. This improvement would spread to the upper incisors and allow the placement of posterior bite turbos on the occlusal surfaces of the mandibular molars, which would immediately open the bite during the treatment procedure. After adequate intermaxillary space had been produced, Cu–NiTi archwires effectively achieved dentition alignment and leveling without causing any occlusal interference.[17]

For anterior bite turbos when it comes to solving anterior crossbites, utilizing bite turbos on the lower incisors can be an effective treatment approach. Flowable resin is often the ideal material for constructing lower anterior bite turbos, as it allows for easy adjustment and manipulation to achieve the desired bite opening. Additionally, the vertical dimension of the bite turbo should be carefully designed to open the intermaxillary space, ensuring proper occlusion and alignment during the active orthodontic treatment. By using anterior bite turbos in Class III situations, orthodontic professionals can help patients achieve improved dental function and esthetics.[18] Patients displaying retroclined maxillary anterior teeth with an anterior crossbite, well-aligned mandibular anterior teeth without proclination, average to horizontal development trends, or an inclined bite correction anteriorly may experience benefits. Fluid resin is used to affix anterior slant bite turbos to the lower anterior teeth.[19] The inclined plane and upper anterior teeth should be appropriately angulated concerning the vertical disparity that exists between the mandibular and maxillary arches. In 3–4 weeks, a greater percentage of anterior dental crossbites can be corrected with an inclined plane.[20] When the occlusion is disoccluded, ensure the bite opening is bilateral and comfortable for the patient. In this case, the bite turbo opened the bite to accelerate the initial stage of the orthodontic treatment. At the same time, intermaxillary Class III elastics were used with the whole maxillary dentition acting as anchorage to retract the mandibular dentition. Brackets with the appropriate torque, bite turbo, and light force Class III elastics were used in malocclusion treatments, and it only took three months to correct the anterior crossbite. Bite turbos and Class III elastics functioned together to efficiently level and align multiple teeth. The Class III mechanics extruded maxillary molars, rotated the occlusal plane in a counter-clockwise direction, and changed the axial inclinations of the incisors in both arches.[21] Protraction of the molars with intra-arch mechanics resulted in retraction of the lower anterior segment.[22] Bite turbos were attached to the patient's anterior teeth to augment the intermaxillary space and enhance the vertical dimension of the occlusion. The front bite turbine assisted in expanding the bite to rectify Spee's excessively curved jaw. When the lower lip protrudes, it is recommended to treat anterior crossbite by retracting the lower anterior teeth. Previous bite turbos were positioned on the lingual surface of the lower incisors, resulting in the enlargement of the bite and the correction of the anterior crossbite. Lower anterior bite turbos are preferable whenever feasible because they enable the implementation of early light short Class III elastics, which are used to secure the posterior bite. To retract the mandibular anterior teeth and raise the axis inclination of the maxillary anterior teeth, early light short Class III elastics were employed.[23]

Conclusions

Without orthognathic surgery, the effective treatment for demanding skeletal malocclusion was finished in just 10 months. The patient received effective treatment by applying anterior bite turbos together with early light short Class III elastics and box elastics. Early light short Class III elastics, sometimes known as box elastics, successfully addressed one of the primary concerns following active treatment—the anterior open bite. Long-term follow-up was required to ensure the occlusion's continued stability and maintenance. In this complicated situation, an acceptable conclusion was made possible by the use of a Hawley retainer and careful monitoring every 6 months.

Conflict of interest

There are no conflicts of interest.

Authors contributions

Not applicable.

Acknowledgement

The Can Tho University of Medicine and Pharmacy's Faculty of Odonto and Stomatology, Can Tho City, Vietnam, is acknowledged for its financial support by the authors.

Financial support and sponsorship

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors contributions

All authors contributed equally to this work.

Ethical policy and Institutional Review Board statement

Ethics committee approval was received for this study from the Ethics Committee in Biological Research of Can Tho University of Medicine and Pharmacy, Can Tho City, Vietnam.

Patient declaration of consent

All operations have earned informed consent filled by the patient.

Data availability statement

Available on request from the corresponding author, Lam Nguyen Le (lenguyenlam@ctump.edu.vn).

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