



RESEARCH ARTICLE

ORTHODONTIC MANAGEMENT OF A COMPLEX OPEN BITE CASE USING MODIFIED VERTICAL HOLDING APPLIANCE: A CASE REPORT

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ABSTRACT

Managing open bite cases whether dental or skeletal in nature, can be quite challenging. This case report illustrates treatment of a 16-year-old female patient with complex open bite presented with 2 mm of anterior open bite and 4 mm of posterior open bite along with increased lower anterior facial height and inclination angle. Treatment was carried out by camouflage non-extraction fixed orthodontic mechanotherapy with focus on intrusion of the maxillary molars & uprighting of the anterior teeth.

Key Words:

Complex Open Bite, Camouflage Non-Extraction, Fixed Orthodontic Appliances.

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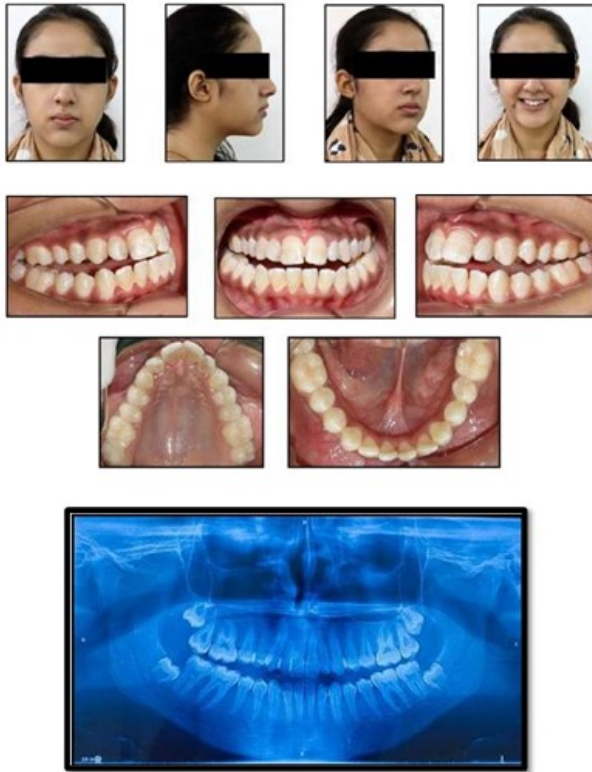
INTRODUCTION

Open bite presents a challenging malocclusion characterised by insufficient vertical overlap between the anterior teeth when the posterior teeth are in occlusion. Its prevalence varies between 1.5% and 11% across different age groups and ethnicities. Open bite is generally classified as dental, skeletal, or the combination of both. It can also be classified as simple, compound or complex openbite. Complex open bite is severe vertical malocclusion in which the teeth occlude only on second molars¹. Diagnosing an open bite case requires a combination of cephalometric and functional analysis to better understand its etiology. A skeletal open bite is generally identified in patients presenting a hyperdivergent profile based on vertical-cephalometric parameters, including an increased mandibular plane angle, an enlarged gonial angle, a high Björk sum, a decreased facial height ratio, or an anteriorly inclined maxilla (increased inclination angle). A dental open bite is diagnosed when a patient exhibits normal vertical cephalometric parameters yet presents with labioversion of the anterior teeth, reduced anterior dental height, or increased posterior dental height. Nonetheless, in several instances, the distinctions between dento-alveolar and skeletal open bite are not well delineated, since malocclusion exhibits both dental and skeletal components.

Anatomic condition such as tongue size and position have been shown to be responsible for affecting dental and skeletal components of anterior open bite². Another anatomic situation that causes mouth breathing, for example: nasopharyngeal and/or oropharyngeal obstruction, may develop into open bite, however, their direct correlation has not been proven³. Resorption of the mandibular condyle or other conditions that may induce morphological alterations of the condyle have been recognized as etiological factors of anterior open bite. Numerous behaviours such as digit sucking, anterior tongue position, and tongue thrusting have been identified as environmental contributors to anterior open bite^{4,5}. In adults, correcting open bite is a great challenge in orthodontics, and several approaches have been addressed. It must be kept in mind that treatment strategies should always be adjusted according to etiologic factors⁶. This case report illustrates a nonsurgical treatment approach for a patient with complex open-bite malocclusion. She was treated with non-extraction fixed orthodontic mechanotherapy with focus on molar intrusion using a modified vertical Holding Appliance, called "G- VHA".

CASE REPORT

A 16-year-old female patient had reported to the Department of Orthodontics with the chief complaint of a difficulty in incising food with her front teeth and in chewing. She had no trauma history and no signs and symptoms of TMJ disorder.



Lateral Cephalogram	Sagittal Skeletal Components		
	Pretreatment	Inference	
	SNA	79°	Class I
	SNB	76°	
	ANB	3°	
	WITS appraisal (mm)	0 mm	
	Vertical Skeletal Components		
FMA	29°	Hyperdivergent	
SN-MP	38°		
Gonial Angle	127°		
LAFH	56 %		
Inclination Angle	90°	Upward And Forward Inclined	

Dental Components		
U1-NA (°)	31°	Proclined
U1-NA (mm)	4.1 mm	Normal
U1-PP (°)	63°	Proclined
U1-PP (mm)	28.8 mm	Normal
U6-PP (mm)	23.3	Normal
L1-NB (°)	33°	Proclined
L1-NB (mm)	6.5 mm	Normal
IMPA (°)	97°	Proclined
L1-MP (mm)	40 mm	Normal
L6-Mp (mm)	30 mm	Normal
Interincisal Angle (°)	114°	Proclined

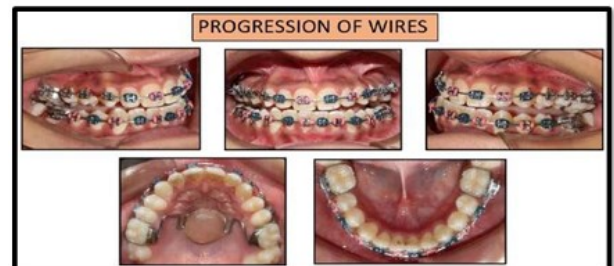
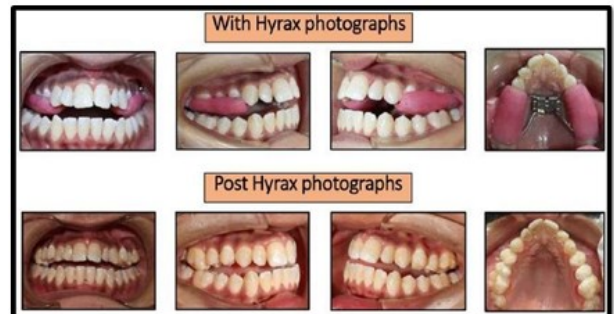
Soft tissue findings :			
E - line (mm)	Upper lip (-4mm)	-4.2 mm	Normal
	Lower lip (-2 mm)	0 mm	protruded
Nasolabial angle	(102°±8)	110°	Increased
Lip strain		4 mm	present

Clinical findings: The patient had apparently symmetrical, mesoprosopic face with convex profile and competent lips. Smile analysis showed Morley's ratio of 90 % and wide buccal corridors were present. The intraoral molar relationships were Super Class I bilaterally, whereas the canine relationships were unable to be distinguished on both sides, with open bite extending from first molar to first molar on opposite side with anterior open bite of 2 mm and posterior open bite of 4 mm and Overjet of 0 mm. Bilateral posterior crossbite were present with narrow maxillary arch. The arch length tooth material discrepancy was 5 mm in the maxillary arch and 2.4 mm in the mandibular arch.

The lower dental midline was deviated to the right side by 1 mm. Lateral cephalometric analysis showed a Skeletal Class I relationship with Hyperdivergent growth pattern and CVMI Stage IV. An Orthopantomogram was also recorded which showed erupting third molars in all four quadrants.

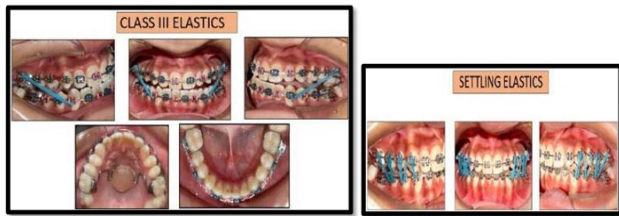
Treatment Objective/ Goals

- Extraction of 3rd molars
- Correction of open bite
- Correction of posterior crossbite
- Correction of Mid-line
- Achieving optimum overjet and overbite.
- Achieving Class I Molar Relationship bilaterally.
- Achieving Class I canine relationship on bilaterally.
- Achieving optimum soft tissue balance.
- Long term retention.



Treatment plan: Phase I - Treatment with Hyrax expansion appliance Phase II - Non-Extraction Fixed orthodontic mechanotherapy with preadjusted edgewise (MBT-022X028" slot) appliance. Long term retention in both maxillary and mandibular arch.

Treatment Progress: Treatment starts with bondable hyrax expansion appliance to correct the bilateral posterior crossbite followed by Preadjusted edgewise MBT 0.022 slot brackets bonded in both the arches, and initial alignment was done using 0.016 NiTi wire. Modified Vertical holding appliance (G-VHA) was inserted for the purpose of molar intrusion.



Post Debonding- Intra-oral Photographs



Post Debonding- Extra-oral Photographs



Post - Treatment

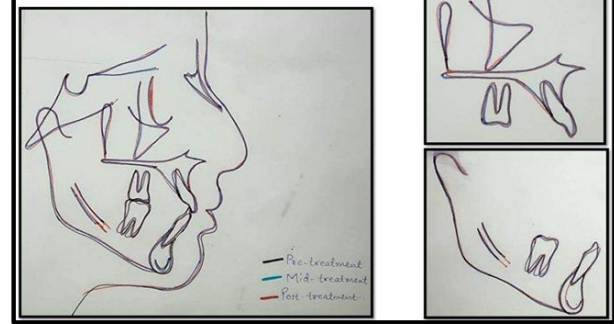


Post - Treatment		Sagittal Skeletal Components	
		Pre-treatment	Post-treatment
		SNA 79°	77°
		SNB 76°	76°
		ANB 3°	1°
		WITS appraisal (mm) 0 mm	0 mm
		Vertical Skeletal Components	
		FMA 29°	28°
		SN-MP 38°	37°
		Gonial Angle 127°	127°
		LAFH 56 %	56 %
		Inclination Angle 90°	90°

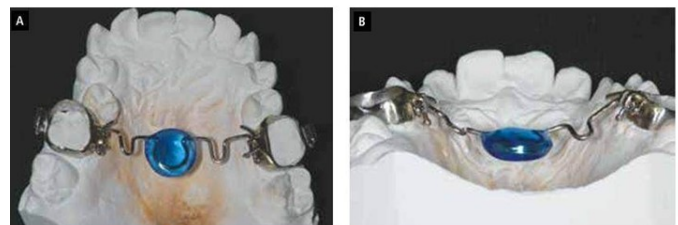
Dental Components		
U1-NA (°)	31°	30°
U1-NA (mm)	4.0 mm	4.0 mm
U1-PP (°)	63°	63°
U1-PP (mm)	28.8 mm	28.8 mm
U6-PP (mm)	23.3 mm	22.2 mm
L1-NB (°)	33°	29°
L1-NB (mm)	6.5 mm	6.6 mm
IMPA (°)	97°	96°
L1-MP (mm)	40 mm	40 mm
L6-Mp (mm)	30 mm	30 mm
Interincisal Angle (°)	114°	117°

Soft tissue findings :			
E-line (mm)	Upper lip (-4mm)	-4.2 mm	-4 mm
	Lower lip (-2 mm)	0 mm	-1.1 mm
Nasolabial angle	(102°:8)	110°	108°
Lip strain		4 mm	2.2 mm

Superimpositions



Treatment results: Post-treatment photographs showed an acceptable facial profile. Intraorally, the dental midline was almost coincident with facial midline. Ideal interdigation with Angle Class I molar relationship and Class I canine relationship and proper overjet and overbite were achieved. The smile appearance improved and the esthetic profile of the patient was maintained. Post treatment Orthopantomogram showed ideal mesiodistal angulations of the dentition.



DISCUSSION

To effectively treat the open bite, a number of vertical posterior control strategies have been put forward, which aim to prevent maxillary molar extrusion and encourage a more favourable mandibular counterclockwise rotation. To prevent molar extrusion, the majority of options are available— such as high-pull, facebow headgear— but requires a high degree of patient compliance⁷. Wise et al. [1994] demonstrated how the use of a conventional trans-palatal arch might be beneficial in vertical control during their search for low or no compliance devices. This prevented maxillary molar extrusion with low compliance, achieving 0.20 mm extrusion per year as opposed to 1 mm per year in a control group⁸. In 2008, Gracco and Spina suggested a vertical holding device with a resin pad that touches the tongue and applies pressure on the maxillary molars, causing enough intrusion (0.4 mm) to cause the mandible to rotate counterclockwise⁹. The G-VHA is a detachable trans-palatal bar composed of 0.9 stainless steel wire, with a resin plate covering the Coffin loop entirely. In order to push on the tongue and apply a vertical force to the maxillary molars, the bar is positioned 5–7 mm away from the

An archwire sequence of 0.018 NiTi, 0.018 SS, 0.017 × 0.025 NiTi and 0.017× 0.025 SS was followed. A 0.019 × 0.025 SS wire was placed in both arches for 6 weeks along with Class III elastics for achieving a canine guided occlusion followed by settling elastics. Bracket repositioning was done and 0.014 NiTi wires were used for final finishing and detailing. After completion of treatment the patient was given fixed palatal/lingual retention in both maxillary and mandibular arch to prevent relapse. Post- treatment radiographs were taken and cephalometric tracing was done.

palate. This causes a shift in the posture of the tongue. In addition to the primary omega loop, two supplementary lateral loops have been modelled to vertically re-activate the bar and simultaneously adjust the molars' transverse, vertical, and sagittal positions. The lateral loops can be widened to activate the bar and execute molar expansion and de-rotation. Additionally, by bending the lateral loops along the vertical plane, the resin pad can be moved farther from the palate to increase the vertical force given to the upper molars¹⁰. The patient's chief complaint in this particular case was mostly functional, pertaining to mastication and speaking. Aesthetic-related complaints were minimal, only the insufficient display of the maxillary anterior teeth upon smiling was her primary concern. The patient's balanced facial appearance and profile played an important role in the decision for a non-surgical treatment option. The correction of the anterior open-bite in the present case resulted mostly from intrusion of the maxillary molar & uprighting of the anterior teeth and mesial movement of posterior teeth to create draw-bridge effect and wedge effect for improvement of open bite and counterclockwise rotation of the mandible using G-VHA. Maintaining the outcomes of treatment with either permanent or removable retainers is crucial, particularly to avoid labial flaring of the incisors. In individuals with residual growth, retainers with occlusal covering may be useful in halting further molar eruption. If the open bite was caused by abnormal tongue position and function, these factors could also be involved in recurrence after therapy. Therefore, using lingual spurs or a tongue crib during or after therapy may increase stability.

CONCLUSION

The present case report details the non-surgical orthodontic treatment of a patient with a complex open-bite treated using a combination of maxillary arch expansion, upper molar intrusion, fixed orthodontic treatment and intermaxillary elastics. Therefore, this treatment modality can be considered an acceptable alternative to orthognathic surgery in selected cases in which the dental malocclusion—rather than facial aesthetics—is the primary patient concern. However, long term retention should be given to improve stability.

Declarations

Ethics approval and consent to participate: N/A

Consent for publication: Written informed consent obtained from the patient's guardian for publication of this case report and any accompanying images.

Availability of data and material: All data generated or analyzed during this study included in this published article and its supplementary information files.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that his name and initials will not be published and due efforts will be made to conceal his identity.

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