Non-Surgical Management of Anterior Open Bite in an Adult Using Modified MEAW Technique with Anterior Box Elastics: A Case Report

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Article Info.

Submitted: Jan 26, 2026
Accepted: Apr 21, 2026

How to Cite?

Karki P, Pokharel R, Bajracharya S, Kafle D. Non-surgical management of anterior open bite in an adult using modified meaw technique with anterior box elastics: a case report. Orthod J Nepal. 2025;15(2):21-6

DOI: https://doi.org/10.3126/ojn.v15i2.89951

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ABSTRACT

Anterior open bite is a challenging malocclusion with multifactorial etiology involving skeletal, dentoalveolar, and functional components such as tongue thrusting. Management in adults is difficult due to the absence of growth potential and concerns regarding long-term stability. This case report describes non-surgical management of a 22-year-old male with a 4 mm anterior open bite, tongue thrusting habit, proclined incisors, and increased lower facial height on a skeletal Class I base using a modified MEAW (Multiloop Edgewise Archwire) technique. The case is unique due to integration of simplified MEAW mechanics using accentuated/reverse curve NiTi archwires, anterior box elastics, and simultaneous habit interception. Active treatment was completed in 16 months with adjunctive myofunctional therapy, achieving positive overbite, ideal overjet, Class I occlusion, elimination of tongue thrusting, and improved facial esthetics. This case highlights that modified MEAW with anterior box elastics and habit control is an effective, practical, non-surgical approach for managing dentoalveolar anterior open bite in adults.

Keywords: Anterior box elastics, Anterior open bite, Modified MEAW technique.

INTRODUCTION

Open bite is defined as the absence of vertical overlap between the maxillary and mandibular teeth, which may involve the anterior or posterior segments.[1] Open bite incidence varies depending on age and ethnic group. Highest prevalence of open bite is 7.82% as reported among African population and 4% in Asian population.[2] A study conducted by Shrestha et al., reported 5% prevalence of open bite in Eastern Nepal.[3]

According to Dawson, etiology behind open bite is multifactorial. Thumb sucking, pacifier sucking, lip biting, tongue thrusting habits, tongue position at rest, genetics, airway obstruction, enlarged adenoids can contribute open bite problems.[4] Based on the underlying etiological factors, anterior open bite may be broadly classified into dental and skeletal open bite. Skeletal anterior open bite is typically associated with a hyperdivergent growth pattern and is characterized by increased lower anterior facial height, steep mandibular plane angle, vertical maxillary excess, short posterior facial height, and clockwise mandibular

ISSN: 2091-1327 (Print), 2091-1335 (Online)

rotation.[5] Clinically, these patients often present with lip incompetency, increased interlabial gap, and occlusal contacts limited to the posterior teeth with divergence of the occlusal planes anteriorly. In contrast, dentoalveolar open bite occurs with relatively normal skeletal relationships and is mainly related to altered incisor eruption or habits such as tongue thrusting or digit sucking, characterized by incisor proclination and reduced dentoalveolar height. Clinically, open bite is associated with functional disturbances including compromised mastication, speech and difficulty in incising food is commonly reported chief complaint.

Treatment of open bite is challenging, as it is difficult to differentiate between dentoalveolar open bite and skeletal open bite, moreover the growth pattern of an individual also determines the treatment strategy. Clinical findings should be interpreted in conjunction with cephalometric analysis. Cephalometric parameters such as mandibular plane inclination, facial height ratios, and palatal plane angulation, as described by Cangialosi, can aid in diagnosis; however, no single parameter is definitive, and a combined clinical and radiographic assessment is required.[6]

In adults, open bite cases can be managed with orthodontic and surgical approaches depending on severity. Non-surgical correction involves incisor extrusion or molar intrusion using appropriate biomechanics.[7] Kim in 1987 suggested that an understanding of origin of open bite and dynamics of orthodontic mechanotherapy, anterior open bite could be treated with high degree of success and stability without surgical intervention.[8] The novel technique involves multiloop gable bend archwires with vertical elastics, known as the Multiloop Edgewise Arch Wire (MEAW) technique, aimed at correction of the inclination of the occlusal planes, alignment of the maxillary incisors relative to the lip line, and uprighting of the axial inclinations of the posterior teeth. Traditional MEAW uses stainless steel archwires with multiple loops for low load-deflection mechanics, whereas Enacar et al. proposed a modified approach by replacing the multiloop gable bend archwire with 0.016×0.022-inch upper accentuated-curve and lower reverse-curve nickel-titanium archwires, used in combination with intermaxillary elastics applied in the canine region (Fig. 1).[9] The modification has simplified appliance design, improved oral hygiene maintenance, and reduced chairside time while achieving comparable clinical outcomes.

This article describes the non-surgical management of an adult patient with anterior open bite using a modified MEAW technique combined with anterior box elastics, highlighting the diagnostic considerations, biomechanical rationale, treatment progression, and short-term stability of the achieved results.

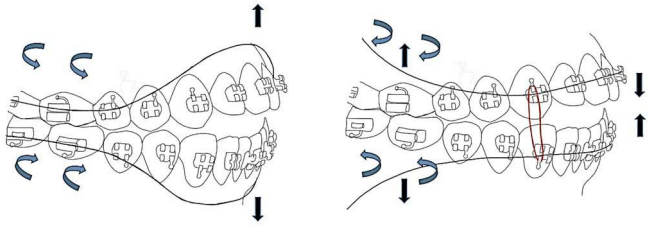


Fig. 1: Modified MEAW technique.

CASE REPORT

A 22-year male patient reported to the Department of Orthodontics and Dentofacial Orthopaedics, Kathmandu Univesity School of Medical Sciences (KUSMS), Dhulikhel, with the chief complaint of difficulty in biting with the front teeth and had esthetic concern. The patient expressed inability to incise food efficiently, which had been persistent for several years. There were no relevant medical history and family history was non-contributory. Habit history revealed a long-standing tongue thrusting habit since childhood, with no associated thumb sucking or mouth breathing.

Extraoral examination revealed an apparently symmetrical face with a hyperleptoprosopic facial form and a brachycephalic head pattern. The facial profile was convex with posterior divergence. Lips were competent at rest, and mentalis muscle activity was normal. Vertical facial assessment showed an increased lower anterior facial height. Upper and lower dental midlines coincided with the facial midline. The nasolabial angle was reduced and smile analysis demonstrated a non-consonant smile arc with a low lip line. No abnormalities were detected on temporomandibular joint evaluation, and mandibular range of motion and mouth opening were within normal limits.

Intraoral examination revealed lateral indentations on the tongue, and functional assessment confirmed the presence of a tongue-thrusting habit. Hard tissue examination revealed an anterior open bite and an edge-to-edge relationship in the posterior region. Both maxillary and mandibular arches were U-shaped and symmetrical, with proclination of anterior teeth (Fig. 2). Inter-arch evaluation revealed bilateral Class I molar, bilateral Class II canine and premolar relationships with a net overjet of 2.5 mm and a negative overbite of -4 mm.

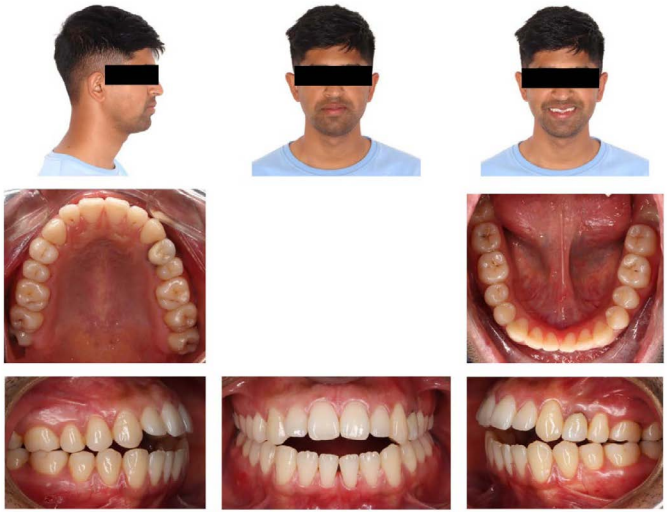


Fig. 2: Pre-treatment extraoral and intraoral photographs.

Study model analysis revealed moderate crowding in both arches with overall and anterior mandibular tooth material excess. Radiographic and cephalometric evaluation revealed skeletal Class I relationship with normognathic maxilla and mandible, normal growth pattern, proclined and forwardly placed upper and lower incisors, decreased interincisal angle, increased lower anterior facial height, retrusive upper and normal lower lips (Fig. 3, Table 1).

Cephalometric evaluation using Sassouni and Björk analysis showed convergence of craniofacial planes and Björk's sum of 396°, indicating balanced vertical proportions and normal growth pattern. These findings suggest a predominantly dentoalveolar origin of the open bite despite increased lower facial height.

Based on the overall clinical and cephalometric findings, the patient was diagnosed with Angle's Class I malocclusion with Dewey's modification Type II on a skeletal Class I base with dentoalveolar anterior open bite and was planned for non-extraction orthodontic treatment using modified MEAW technique with anterior box elastics, along with habit control measures to enhance treatment efficiency and stability.

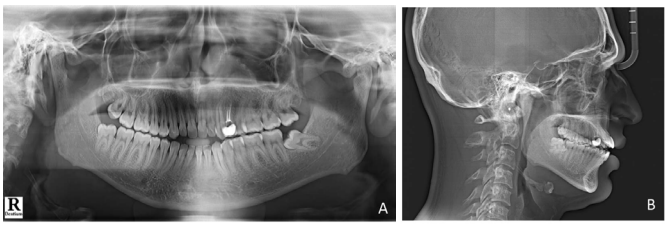


Fig. 3: Pre-treatment radiographs.
A. Orthopantomogram B. Lateral cephalogram

Table 1. Comparative cephalometric parameters.

Cephalometric parameters	Clinical norms	Pre-treatment values	Post-treatment values
Skeletal parameters			
SNA	82 ± 2°	80°	80°
SNB	80 ± 2°	78°	78°
ANB	2 ± 2°	2°	2°
Wits	-1 mm	0 mm	-3 mm
FMA	25 ± 5°	23.5°	24°
SN-GoGn	32 ± 2°	32°	32°
Dental parameters			
UI-NA	22 ± 2°/4mm	36°	29°
UI-SN	104° ± 2°	117°	109°
UI-A Pog	2.7 ± 1.8 mm	9 mm	8 mm
LI-NB	25 ± 2°/4mm	33°	29°
LI – A Pog	2.7 ± 1.7 mm	6 mm	5.5 mm
IMPA	90 ± 5°	102°	95°
Interincisal angle	134°	109°	120°
Soft tissue parameters			
Nasolabial angle	102 ± 8°	92°	92°
E-line (Upper lip)	-4 mm	-5 mm	-4 mm
E-line (Lower lip)	-2 mm	-2 mm	0 mm

The primary objectives of treatment were to correct anterior open bite, achieve ideal overjet, overbite, and functional occlusion, eliminate tongue-thrusting habit, improve smile esthetics and facial harmony while maintaining skeletal Class I relationship, and ensure long-term stability. The case was planned for non-extraction orthodontic treatment using modified MEAW approach with emphasis on vertical control and habit correction. Therapeutic extraction of all third molars was carried out to facilitate uprighting of posterior teeth.

Fixed mechanotherapy was carried out using pre-adjusted edgewise appliance with 0.022-inch slot MBT prescription brackets. Initial leveling and alignment were achieved using nickel-titanium archwires. Habit interception was initiated using a tongue crib, maintained for 6 months (Fig. 4A). With progression to modified MEAW mechanics, the tongue crib was discontinued, and a bonded lingual reminder appliance using metal brackets was placed on the palatal surfaces of maxillary anterior teeth (Fig.

4B). The patient was instructed in tongue exercises for neuromuscular re-education.

After leveling and alignment, 0.017" × 0.025" accentuated curve of Spee NiTi in maxillary and reverse curve of Spee NiTi in mandibular arch were placed. Anterior box elastics (5/16", 2.5 oz) and triangular elastics (3/16", 4.5 oz) from maxillary canines to mandibular canines and first premolars were used to guide vertical correction, and facilitate closure of anterior open bite. Both elastics were used for 6 months, followed by triangular elastics for 3 months for settling and stabilization (Fig. 5). During this phase, force was reduced to 3.5 oz to maintain occlusion while minimizing the risk of relapse.

At the end of active treatment, completed over a period of 16 months, a positive overbite and ideal overjet were achieved with satisfactory intercuspation. Proclination of incisors and crowding was resolved in both arches. Class I molar and canine relationships were established bilaterally as shown in Fig. 6 and Fig. 7. The tongue thrusting habit was successfully eliminated, contributing to improved functional stability. Facial esthetics and smile harmony showed noticeable improvement, with maintenance of a balanced soft tissue profile.

American Board of Orthodontics (ABO) superimposition showed anterior incisor extrusion with mild posterior intrusion and uprighting, contributing to open bite closure. Quantitative assessment demonstrated approximately 3.2 mm of incisor extrusion and 0.52 mm of molar intrusion (Fig. 8).

Following active treatment, retention was achieved using fixed bonded lingual retainers in both arches. Additionally, a maxillary Begg/wrap-around retainer with a posterior bite plane and anterior palatal opening was delivered as a reminder appliance to reinforce tongue posture and maintain vertical correction (Fig. 9). This combined approach ensured mechanical stability and habit control. Fig. 10 shows the extraoral and intraoral photographs at 3 months follow-up.

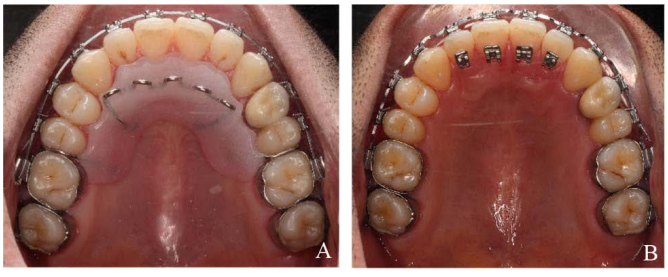


Fig.4. A: Tongue crib B. Bonded lingual reminder appliance using metal brackets for tongue thrust control.

Fig. 5: Progress intraoral photographs.

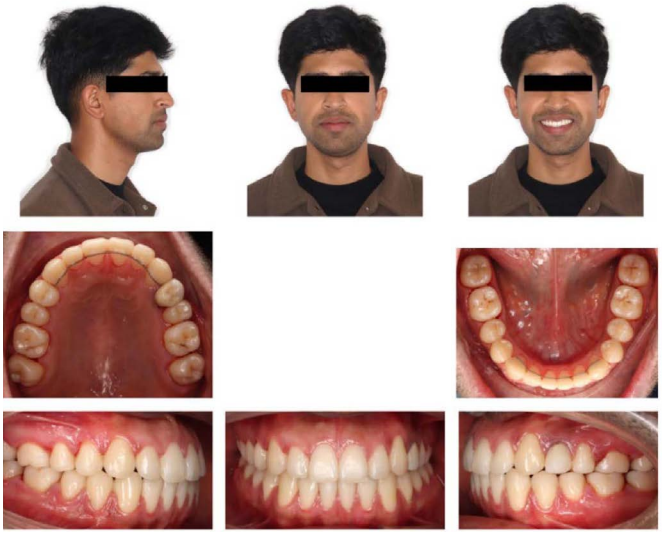


Fig. 6: Post-treatment extraoral and intraoral photographs.

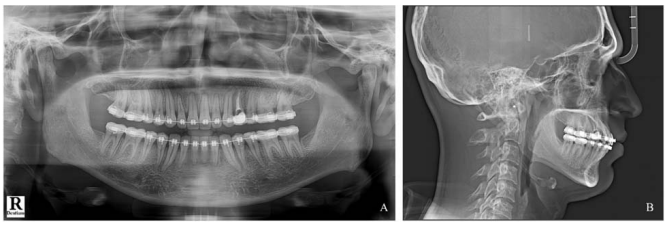
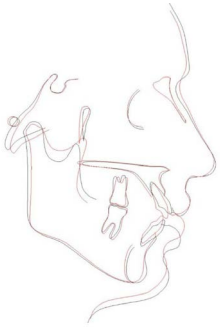


Fig. 7: End-treatment radiographs.
A. Orthopantomogram B. Lateral cephalogram



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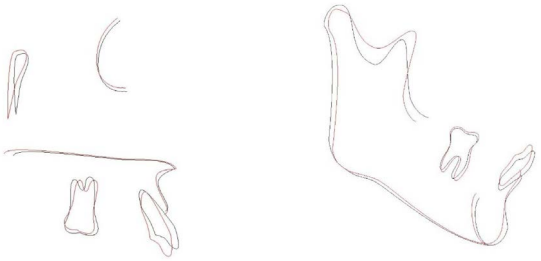

B C

Fig. 8: Cephalometric superimpositions:
A. Overall superimposition; B. Maxillary superimposition; C. Mandibular superimposition. Black: Pre-treatment; Red: End-treatment.

Fig. 9: Maxillary Begg retainer with posterior bite plane and anterior palatal opening designed to maintain vertical correction and discourage tongue interposition.

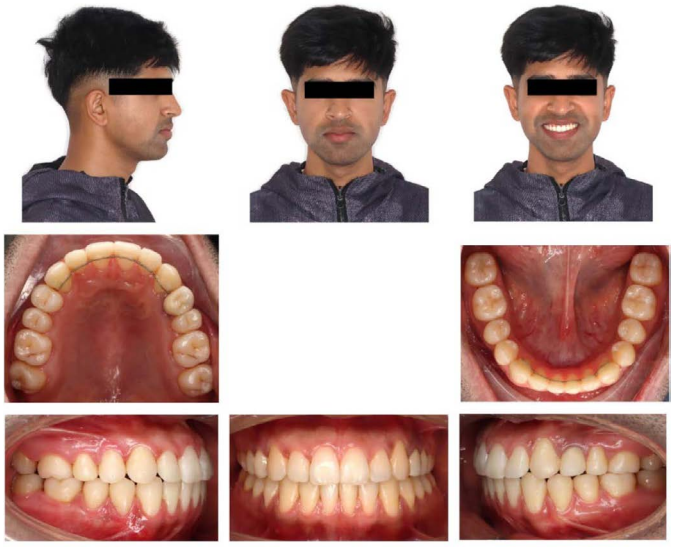

Fig. 10: Intraoral and extraoral photographs at 3-month follow-up.

DISCUSSION

Anterior open bite malocclusion is a complex condition involving both skeletal and dentoalveolar factors. The distinction between skeletal and dental open bite is clinically important, as treatment strategies and long-term stability differ accordingly.[10] Management depends on the patient's growth status, severity of the malocclusion, and treatment objectives. Conventional orthodontic and orthopedic approaches have traditionally focused on restricting vertical maxillary growth using headgear, controlling mandibular growth with chin cups, and extruding anterior teeth using vertical elastics.[11,12] Other modalities described in the literature include habit control appliances such as tongue cribs, posterior bite blocks, posterior magnets, magnetic vertical correctors, and functional appliances, particularly in growing patients.[12]

Among non-surgical approaches, the MEAW technique introduced by Kim has been shown to be effective, particularly in nongrowing patients.[8] It utilizes 0.016 × 0.022-inch stainless steel archwires placed in 0.018-inch slot brackets, combined with vertical elastics delivering approximately 50g of force. This force system was designed to extrude and retract anterior teeth while simultaneously uprighting posterior teeth, thereby facilitating bite closure. Kim et al. further demonstrated favorable long-term stability with this approach, reporting minimal relapse at a two-year follow-up.[13,14] Although MEAW therapy is effective in dentoalveolar correction, it has limited influence on the underlying skeletal pattern. Based on Kim's principles, Enacar et al. proposed a simplified modification using upper accentuated and lower reverse curve nickel-titanium archwires, offering a simpler and more hygienic alternative.[9]

In the present case, a modified MEAW protocol was employed using 0.017 × 0.025" reverse NiTi wire on 0.022" MBT prescription bracket. These curved archwires generate an intrusive force on both anterior and posterior dentoalveolar segments; however, the application of anterior vertical elastics counterbalances the intrusive effect on the anterior teeth, redirecting the force to the posterior segments. This results in posterior uprighting and intrusion, facilitating counterclockwise autorotation of the mandible and progressive closure of the anterior open bite. The bite-closing mechanism and clinical response observed in this case were consistent with those described by Kim and Enacar et al., wherein anterior open bite closure is achieved through posterior tooth uprighting combined with controlled anterior extrusion and retraction, accompanied by changes in the inclination of maxillary and mandibular occlusal plane towards each other.[8,9]

Quantitatively, approximately 3.2 mm of anterior incisor extrusion and 0.52 mm of molar intrusion were achieved, indicating that open bite correction occurred primarily through anterior extrusion with minimal posterior vertical change. These results are comparable to findings by Erdem and Küçükkeles, who reported significant incisor extrusion with negligible molar vertical changes, and by Kim et al., who demonstrated limited molar intrusion (~0.66 mm)

with MEAW therapy.[13,15] This supports the concept that bite closure is mainly driven by anterior extrusion and posterior uprighting rather than true molar intrusion.

Long-term stability remains a concern in anterior open bite treatment. Lopez-Gavito et al. reported relapse in approximately 35% of cases, whereas Katsaros and Berg observed more stable outcomes when proper biomechanics and retention were implemented.[12,16] Stability is highly dependent on elimination of etiologic factors, particularly tongue thrusting, and adequate retention.

In this case, emphasis was placed on habit elimination and controlled anterior extrusion to enhance esthetics while maintaining posterior vertical control. As anterior extrusion is prone to relapse, a retention phase allowing dentoalveolar adaptation is essential.[17] Although favorable short-term outcomes were achieved, lack of long-term follow-up and reliance on two-dimensional cephalometry are limitations. Given the known tendency for relapse, extended follow-up and future studies with CBCT are needed to assess treatment effects and stability of modified MEAW therapy in adult patients.[18]

CONCLUSION

Modified MEAW therapy, combined with appropriate habit interception and patient compliance, can serve as an effective non-surgical treatment option for anterior open bite in adults. Control of vertical mechanics and neuromuscular adaptation is critical for stable and esthetically acceptable outcomes.

ETHICAL CONSIDERATIONS

Written informed consent was obtained from the patient for treatment and publication of clinical data and photographs.

CONFLICT OF INTEREST: None

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