



Use of multiloop edgewise archwire for treatment of patients with Skeletal Open Bite and CI III Malocclusion: A Case Series

Fataneh Ghorbany Javadpour

Assistant Professor, Department of Orthodontics, Faculty of Dentistry, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
Email: fa.ghorbanyjavad@gmail.com

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General Note

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ABSTRACT

Introduction: Multiloop Edgewise Arch Wire (MEAW appliance) is a simple, effective and safe technique in the treatment of anterior open bite. Difficult in Prediction of patients' growth and stability of the treatment results has been a challenge for orthodontists and surgeons. MEAW appliance is a modality introduced for treatment CLIII borderline cases with tendency to anterior open bite and acceptable profile. **Materials and methods:** We present 4 cases treated by this technique accompany with other orthopedic appliances for produce normal over jet and over bite. For cephalometric analysis and superimposition we use Dolphin software version 10.5 (Canoga Park, CA, USA). **Results:** The results of MEAW appliance therapy are relative extrusion of anterior teeth during the growth period, and then correction over jet and overbite and achieved balanced facial profile with improved smile arch.

Although tissue impingement on the buccal alveolar process that could be side-effects of this technique must be considered and counteracted. *Conclusion:* MEAW therapy is a plain, reliable and safe technique for treatment of anterior open bite.

Keywords: Anterior open bite, Cephalometric analysis, Multiloop Edgewise Archwire, Occlusal plane

1. INTRODUCTION

One of the most difficult orthodontic treatment strategies is Open bite, in which prediction of results and stability is very difficult. Treatment strategies should be addressed according to the etiology of malocclusion and age of the patients. Our results showed, the MEAW therapy is a reliable technique in the treatment of this malocclusion. As we know dentition always subjected to the perioral muscles forces such as lips, cheeks and tongue; these forces can produce tooth movement. Since in the normal condition these forces are usually in equilibrium, tooth position is stable (Proffit and Fields, 2013; Ackerman and Proffit, 1997). Effect of tongue position and function on the dentition and facial skeleton is obvious (Kawakami et al., 2005). Anterior open bite is the most challenging malocclusion (Greenlee et al., 2011) and can be divided as dental or skeletal. The 1st one usually caused by oral habits such as finger-sucking and in the 2nd that is more complicated and multifactorial, is usually assisted with a high-angle growth pattern and increased lower facial height. Treatment of open bite depends on the nature of the malocclusion (Nanda and Tosun, 1997). Multiloop edgewise archwire was introduced in 1967 to treat severe anterior open bites and was effective technique and used for treatment of any type of malocclusion especially during the final stage of the treatment (Kim and Han, 2001). MEAW appliance consists of five L-Loops on each side extending from the distal of the lateral incisors to the mesial of the second molars and is constructed with 018 or 016 stainless steel or 16×22 arch wires (018 inch bracket slots) and 17×25 wires (022 inch bracket slots). The function of loops is reducing the load deflection rate (LDR) of the wire and to apply low but continuous forces on teeth. Wire activation involves incorporation of progressive reverse curvature on the wire to provide 3 to 5 degree tip-back bend activation for each tooth from the first premolars to the second molars. This tip-back can upright the posterior teeth and when used with anterior vertical elastics, it can change the occlusal plane and create spaces for up righting the anterior teeth and correcting the open bite. By using progressive buccal root torque we prevent flaring of the posterior teeth and tissue impingement (Wong and Wu, 2007). Here in, we present four cases that treated with MEAW appliance.

2. MATERIALS AND METHODS

Ethical considerations

In this study, the authors have observed fully ethical considerations: Research participants were not subjected to harm in any ways whatsoever. We prioritized respect for the dignity of research participants. For publishing data, including photos, full written consent was obtained from the participants prior to the study (all documents are available and archived). The protection of the privacy of research participants was ensured. Adequate level of confidentiality of the research data was ensured. Furthermore, the present study was approved by the Human Subject Research Ethics Committee of The Ahvaz Jundishapur University of Medical Sciences (Ethical code: IR.AJUMS.REC.1394.111).



Figure 1 Pretreatment facial extra and intraoral photographs of case 1(A-Z)

Diagnosis and treatment modality

A 15 year-old boy with dolichocephalic facial pattern and chief complain of his facial profile and crowded anterior teeth presented for correction of his class III malocclusion with anterior open bite. He had normal periodontal tissues and TMJ functions with no mandibular deviation. He had straight profile and protruded lower lip [Figure 1]. He has unerupted third molars and proclination of upper and lower incisors for decompensation of basic skeletal relationships [Figure 2 and Table 1].

Table 1 Cephalometric data (case 1) (A-Z)

Cephalometric measurements	Pre-treatment	Post- treatment
SNA(°)	68.2	69.3
SNB(°)	69.3	69.5
ANB(°)	-1.1	-0.2
FMA(°)	25.5	32.5
U1to SN(°)	101.2	114.4
IMPA(°)	92	91.7
Inter incisal angle(°)	120.8	107.9

Treatment objectives were:

- 1) Alignment and leveling of the teeth, established a functional occlusion with normal overjet and overbite.
- 2) Achieve balanced facial profile with improved smile esthetics.

Treatment alternatives

We suggested three treatment alternatives as follows:

1. Combined orthognathic surgery and orthodontic therapy to harmonize the molar relationship with extraction of 1st premolars in both arches, by advance the maxilla and bilateral sagittal split osteotomy in the mandible to improve the facial profile and correct the open bite and smile arch.
2. Harmonize the molar relationships and relieve crowding of anterior teeth with extraction of maxillary 2nd and mandibular 1st premolars.
3. Non-extraction orthodontic treatment with Hyrax for palatal expansion; MEAW appliance therapy for correction of anterior open bite; and achieving normal overbite and overjet.

After discussion these alternatives, he chose the 3rd one and declined surgery or extraction any teeth. The 1st phase was expansion of upper arch with quad helix in 5 months and the 2nd was MEAW therapy for relief anterior open bite. For alignment and leveling of upper arch we used 014 and 016 rounded stainless steel archwire and 014 or 016 accentuated curves of Spee wire for the lower arch during 4 months after than 16× 22 NiTi reverse curve of Spee wires was used for 3m and then upper and lower MEAW appliances with three-degree tip-back activation in 16× 22 sized stainless steel archwire was applied along with bilateral 1/8-inch 6 0Z heavy elastic from the upper to the lower loops The total active fix treatment time was 16 months and he had normal occlusion and good appearance [Figure 3].

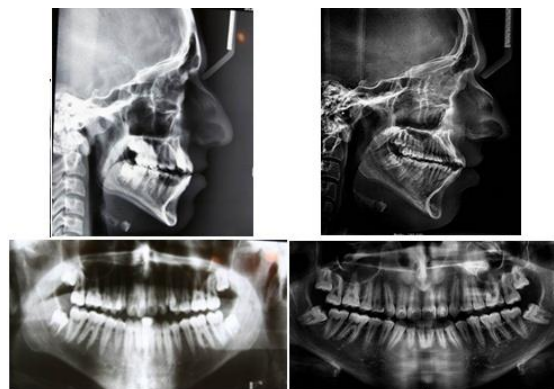


Figure 2 Pre and Post treatment radiographs of case 1(A-Z)



Figure 3 Post-treatment extra and intraoral photographs of case 1(A-Z)(After two years retention time) Case 2

A 10 years old girl with CI III malocclusion and straight facial profile and protruded lower arch. Edge-to-edge incisal relationships with anterior crowding in upper arch. Posterior open-bite due to lateral tongue thrust and under occlusion of premolars [Figure 4].



Figure 4 Pre treatment facial and intraoral photographs of case 2(N-E)

Two phases of treatment plane was:

1-Orthopedic treatment plane included quad helix, fixed tongue guard, and face mask. The mandibular dentition was mesially inclined with upward and forward sloped maxillary and downward and forward sloped mandibular occlusal plane. Therefore the occlusal planes and teeth axial inclinations must be reconstructed to correct this malocclusion; subsequently, the maxillary and mandibular arches were aligned. After four months of treatment with quad helix for upper arch expansion, a fixed tongue guard was inserted for control and repositioning of the tongue and retention; the orthopaedic phase took three years.

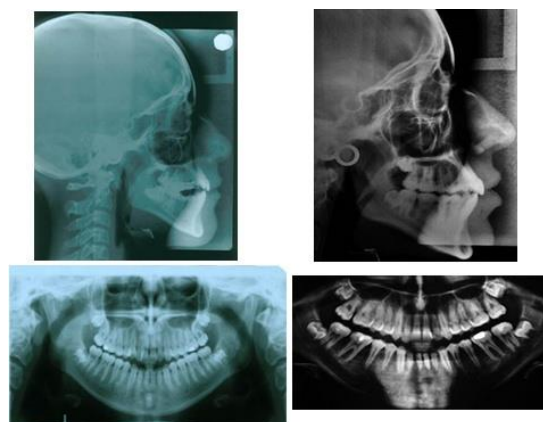


Figure 5 Pre and Post-treatment radiographs of case 2(N-E)

2-The second phase was fixed treatment and started with 022 MBT brackets and Meaw appliances when the patient had 13 years old. Alignment and levelling of both arches was down like 1stcase. After three months, upper and lower Meaw therapy with three-degree tip-back bends activation in 16× 22 sized stainless steel archwire was applied along with bilateral 1/8-inch 6 OZ heavy elastic from the upper to lower loops for seven months, then we had normal overbite and overjet . These elastics were worn full time,

except for eating, and replaced with new ones at bed time. During treatment, improvements in skeletal and dental features such as change in mandibular plane angle, up righting and extrusion of anterior teeth and occlusal plane were obvious [Table 2, Figure 5]. The total active fix orthodontic treatment time was 17 months.

Table 2 Cephalometric data (case 2)(N-E)

Cephalometric measurements	Pre-treatment	Post-treatment
SNA(°)	81.3	79.7
SNB(°)	74.0	73.7
ANB(°)	7.4	6.0
FMA(°)	37.2	40.0
U1to SN(°)	95.9	99.0
IMPA(°)	87.1	94.6
Inter incisal angle(°)	127.3	116.1



Figure 6 Post-treatment facial and intraoral photographs of case 2(N-E) (After two years retention time)

Case 3

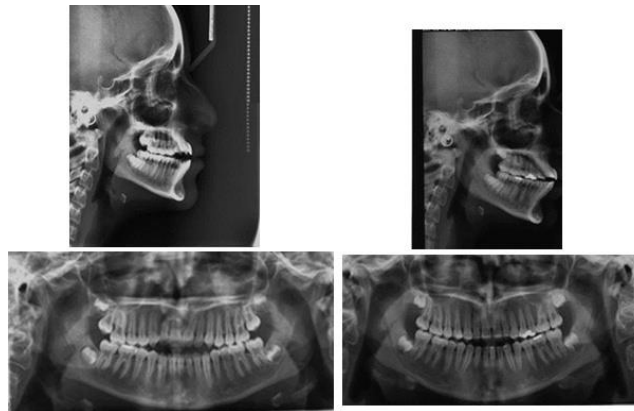
A 9 years old girl with CI III open bite malocclusion [Figure 7]. She chose orthodontic treatment and reluctant surgery. She wear facemask for 9m and after than continue with MEAW appliances.



Figure 7 Pre-treatment facial and intraoral photographs of case 3(P-A)

Table 3 Cephalometric data (Case 3) (P-A)

Cephalometric measurements	Pre-treatment	Post-treatment
SNA(°)	81.9	82.4
SNB(°)	81.1	78.3
ANB(°)	0.9	4.1
FMA(°)	20.9	27.2
U1to SN(°)	116.1	120.9
IMPA(°)	108.2	101.4
Inter incisal angle(°)	106.6	101.6

**Figure 8** Pre- and Post- treatment radiographs of case 3(P-A)**Figure 9** Post-treatment facial and intraoral photographs of case 3 (P-A)**Case 4**

A 16-years-old non-growing female with no compromised medical or dental history. She had a convex profile and incompetent lips; in repose, the gingival show was not presented upon smiling and wide buccal corridors with non-consonant smile arch were seen. On dental analysis, she had CI I molar and CI II canine relationship on both sides with normal overjet and anterior open bite and mild crowding. Posteriorly, she had bilateral crossbite. 1mm upper midline shift to the left and in the lower jaw to the right with asymmetric arches was obvious. Chin deviation to the right and macroglossia and anterior posture of the tongue during rest and upon swallowing were evident. She had normal TMJ and oronasal respiration.

Treatment objectives

1-Correction of dental crowding, 2- Achievement of a functional occlusion, 3-Correction of anterior open-bite and 4- Ensuring stability of treatment [Figures 10, 11].

She had two phases of treatment: in the orthopaedic phase, TPA and tongue guard with high pull headgear were used. Then, in the second phase, teeth in the upper and lower arches were bonded with Roth 022 Slot system brackets; alignment was achieved using 0.014 NiTi and 0.018 stainless steel archwires. Expansion of the upper arch was continued by means of inner face-bow of

headgear, TPA and wires. Levelling of arches was performed using MEAW and extrusion archwires for one year [Figure12]. After that, midline correction was achieved by using a chain and midline elastics. Finally arch coordination, finishing, root paralleling and occlusal detailing were done via elastics. During the retention period Hawley retainers in the upper and lower arches with posterior bite plate were used, final facial photographs showed in figure 13.



Figures 10 Pre-treatment facial and intraoral photographs of case 4 (Sh-P)

Table 4 Cephalometric data (patient 4) (Sh-P)

Cephalometric measurements	Pre-treatment	Post- treatment
SNA(°)	81.2	81.2
SNB(°)	74.7	74.5
ANB(°)	6.5	6.7
FMA(°)	25.4	25.2
U1to SN(°)	102.8	105.1
IMPA(°)	95.0	97.4
Inter incisal angle(°)	130.0	117.2



Figure 11 Pre-and Post-treatment radiographs of case 4 (Sh-P)

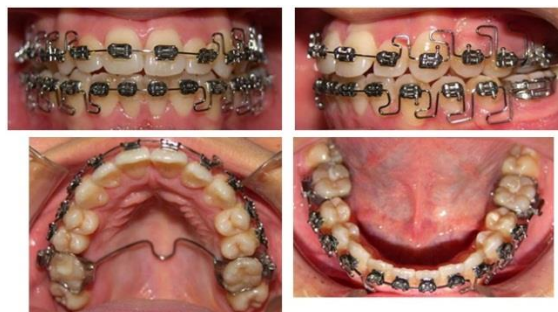


Figure12 Case 4 in progress



Figure 13 Post-treatment facial and intraoral photographs of case 4 (Sh-P)

3. RESULTS

Reliable results with MEAW appliance therapy were achieved with relative extrusion of anterior teeth. Then normalizing overjet and overbite, balanced facial profile with improved smile aesthetics are the results of our treatment in four cases. Flaring of the posterior teeth and tissue impinging on the buccal that could be side-effects of this mechano-therapy must be considered and counteracted with use of trans palatal arch and precise buccal root torque of the arch wire.

4. DISCUSSION

Treatment of CI III open bite cases is a challenge for the orthodontist. Prediction of results is difficult and the amount of growth to be foreseen is unpredictable (Proffit and Fields, 2013; Ackerman and Proffit, 1997). The aetiology of open-bite malocclusion is often related to the environmental factors. Among these factors, the concept of form following function has been singled out as a primary cause; an example is the role of the muscular posture affecting, directly or indirectly, the development of skeletal and dental open bites (Kawakami et al., 2005). Treatment strategies should address the cause of malocclusion (Greenlee et al., 2011; Nanda and Tosun, 1997). Environmental factors like finger or thumb sucking should be identified during the clinical examination and then eliminated. The role of tongue and familial history on the maxillary and mandibular skeleton and dentition is well accepted. Based on this fact, tongue crib and tongue guard appliances are being used for the treatment of anterior open bite (Wong and Wu, 2007; Showkatbakhsh et al., 2013; Taslan et al., 2010). Some authors believe that palatal cribs can correct the open bite just in growing patients presenting Class I malocclusion with balanced facial pattern (Subtelny and Sakuda, 1994; Epker and Fish, 1977). One of the challenges in orthodontics is treatment and stability of open-bite malocclusion especially when the etiologic factor is the size or the posture of the tongue (Ribeiro et al., 2011; Medeiros et al., 2000).

The treatment of excess in the vertical dimension often mimics the treatment of anterior open bite. The different approaches can be separated according to the age of the patient. In growing patients, the focus of the approach is on controlling the eruption of the molars, thereby affecting the skeleton. In adults, the excess vertical length has traditionally been treated with surgery, especially if the hyper-divergent features are associated with a marked dento facial deformity that affects aesthetic. These features are maxillary excess, increased mandibular plane angle, excessive gingival display, retrognathic mandible, long lower facial height and excessive interlabial gap (Medeiros et al., 2000; Uribe et al., 2015). Recently, these patients have been treated by using temporary anchorage devices (TADs). However, this approach is most often attempted only when the vertical excess is associated with an anterior open bite. One treatment modality is the MEAW appliance; it relies on a combination of compliant and noncompliant mechanics in which archwires with specific shapes in conjunction with vertical elastics are used to correct anterior open bite. Most of the reduction in the overbite is achieved by extrusion of anterior teeth with the negligible molar intrusion. Additionally the inter-molar angle gets partially corrected, a change that may aid stability after treatment (Uribe et al., 2015). Flaring of the posterior teeth and loops impinging on the buccal alveolar process could be side-effects of this mechano therapy and must be considered in every patient and counteracted with the use of transpalatal arch (TPA) and precise buccal root torque of the arch wire (Wong and Wu, 2007).

5. CONCLUSION

The results of this study showed that the MEAW therapy is a simple, effective and safe technique in the treatment of anterior open bite. The main etiologic factor for an open-bite in our patients was family history. Equilibrium between tongue and lip pressure was improved so we had better stability in result of treatment. Based on cephalometric measurements, U1-SN and IMPA angles were

increased and Interincisal angle was decreased. A reduction in some indices such as Y-axis, basal, MeGo-Occ and FMA angles shows improvement in skeletal and dental features of open-bite malocclusion with MEAW therapy.

Source of funding

The study was self-funded by the author.

Ethical approval

There was no need ethical code because this case series was an observational study not an interventional type.

Conflict of interest

The author declare that she have no conflict of interest with this study.

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