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# Multi-Loop Edge Wise Arch Wire Technique (MEAW) - A Review

**Dr. Patel Zalak[1], Dr. Desai Manish[2], Dr. Kubavat Ajay[3], Dr. Khyati Patel[4], Dr. Alpesh Vaghela[5]**
[1,2,3,4,5] Sankalchand Patel University, Visnagar

**ABSTRACT:** Anterior open bite treatment is considered to be a complex treatment in the field of orthodontics. Orthognathic surgery is often the treatment of choice for these types of malocclusions and prognosis of the results are still questionable. With the introduction of Multiloop edgewise archwire therapy, treatment of open bite has started showing efficient results. Moreover, MEAW is versatile as it is capable of correcting various malocclusions as well such as Class II, Class III, deep overbite, and malocclusions with marked midline deviations. Since the advent of the MEAW, its treatment modality has been used worldwide and numerous reports of successful results have been published. Some orthodontists have described the MEAW technique as "magical" or "unbelievable," but it certainly is not. The diagnosis and treatment plan must be correct and construction of the MEAW must be precise to deliver the necessary forces to move the teeth to an optimal, stable relationship.Hence this article aims to review the multiloop edge wise arch wire technique in detail along with its biomechanics.

**KEYWORDS:** Arch wire loops, Edgewise, MEAW, Multi-loop edgewise arch wire, Open bite, SATO principle.

## INTRODUCTION

Multi-loop Edge wise archwire (MEAW) is a type of arch wire that was created by Dr. Kim young-Ho.[1]

In 1967, Young H. Kim introduced a treatment philosophy based on anthropological considerations regarding the verticalization of the facial skull during the development of the upright walk of Homo sapiens. The changes in the inclination of the occlusal plane that have occurred in this evolutionary context can also be observed in the individual development of man.[2]

The multiloop edgewise archwire (MEAW) method has quickly gained popularity in the treatment of a number of additional malocclusions despite being initially developed for the treatment of patients with open bite. The theory behind it is that by using the temporomandibular joint's adaptability, specific alterations in the occlusal plane's inclination can be used to correct for different types of malocclusions. Sadao Sato from Kanawaga Dental College of Japan acquired and publicized the MEAW concept further.[3]

According to the theory put forward by Kim and Sato, specific forms of malocclusions can be associated to the vertical position and inclination of the posterior occlusal plane because they directly affect the mandible's anteroposterior position.[4]

The main measures of MEAW therapy are

1) The elimination of the posterior crowding.
2) Uprighting of mesially inclined posterior teeth.
3) Reconstruction of the occlusal plane.
4) Implemented by corresponding activations of the MEAW appliance.[5]

## DESIGN OF MEAW

MEAW is a L- shaped Horizontal Loop (L-loop) in teeth contact areas from the distal side of lateral incisors to the terminal molars. (Fig 1)

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**Fig 1** Basic shape of MEAW

In general, 0.016"x0.022" Stainless steel rectangular wires are used to construct the arch wire. Here, even though the arch shape, loop length etc are all different depending on the size or shape of the dentition.[9]

The basic form of MEAW is the ideal arch that is frequently used in the final stages of the edgewise technique.
The following (fig-2) explains the horizontal loop and the name and the action of each part or area.

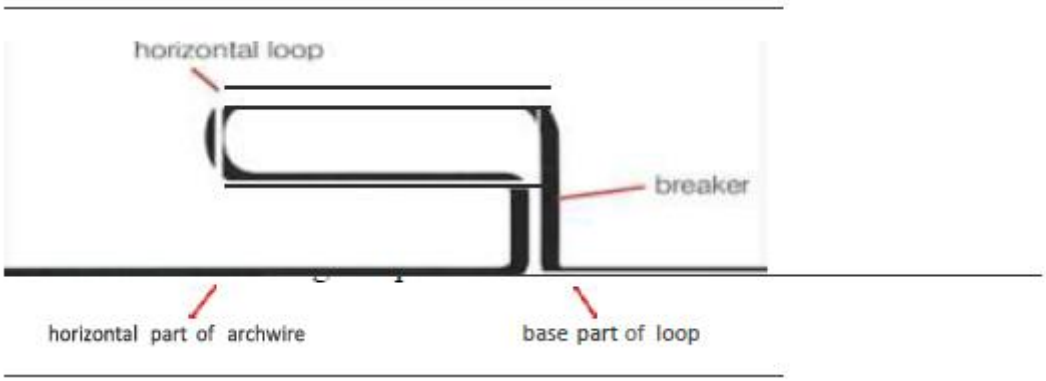


**Fig 2.** Parts of MEAW

a) Horizontal loop: it reduces the vertical force and adjusts the vertical tooth movement
b) Vertical Leg (Breaker): along with the horizontal adjustment, it secures the independent movement of an individual teeth
c) Loop Base: This is the part where the two perpendicularly bent angles meet with each other and where the tip-back bends or torque is controlled.
d) Horizontal part of archwire: this is the part that is inserted into the bracket's slot and conveys the archwire force to the teeth. This part should be straight because the wires should be slipped well into the slot in accordance with the tooth movement.[10] MEAW is 2.5- 3 times longer than the normal archwire because the horizontal loop is applied to the ideal archwire. The orthodontic treatment forces by 1/5 of a .016" x, 022" ideal archwire and makes it possible to apply a consistent orthodontic force to an individual tooth as well as to the whole dentition.[11]

**BIOMECHANICS OF MEAW**

The MEAW appliance's basic treatment mechanics are as follows:

1. It is possible to increase mesio-distal space, improve vertical dimension, and alter the occlusal plane by straightening mesially inclined teeth. The tip-back bends are used to achieve this. As much as 4.5 mm of distalization is produced by molar uprighting at a 15 degree angle.

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2. The amount of tip-back bends may vary depending on each case, the inclination of the occlusal plane and the treatment plane. However, in general a 35º angulation is applied to each tooth and total amount of 1520º angulation is applied
3. Here, by engaging these archwires in the entire dentition and by using the elastics in the anterior part of dentition, the overall improvement of the dentition can be achieved.
4. To improve the arch form, secure the horizontal space by de-rotating the mesially rotated teeth and by expanding the arch.
5. By uprighting the bucco-lingually tilted teeth, it is possible to gain bucco-lingual space, and to obtain an improvement in vertical dimension, an establishment in proper guidance, and a functional occlusion.[12]

Before prescribing the MEAW technique, the following data is needed:
(l) Lateral cephalometric radiograph,
(2) Panoramic radiograph,
(3) Study models.

**1) Lateral cephalogram**

(1) Decide where to place the upper incisors. This is assessed from the distance between the UI and the lip line. 3mrn is considered as normal, but if the distance is less than 0 mm, the extrusion of upper incisors is required, and then the Class II elastics can be used. If it is 6mm or more, the intrusion of upper incisors is required first.
(2) Check the ideal inclination of the occlusal plane. This is the angle between the upper occlusal plane (UOP) and the FH plane, where 10" is considered as normal.
(3) Assess the antero-posterior angulation of lower molars against the occlusal plane.
This is the angle between the posterior occlusal plane (POP) and the FH plane, where 13° is considered as normal. Here, if possible, it is important to make sure that the lower buccal teeth form a right angle with the occlusal plane.[13]

**2) Panoramic Radiograph**

Check points in panoramic radiograph in the finishing stages of treatment.
1. Angulation and parallelism of root.
2. Developmental stage of third molars.

**1) Root parallelism**

This is assessed to confirm the Parallel angulation relationship of all the teeth. Here an assessment is made on whether to bond the bracket again or to adjust it by using finishing arch wires.

**2) Conditions of the third molars**

The correction of posterior crowding is very important in orthodontic treatment. This is considered to be even more important, if there is insufficient posterior vertical dimension (PVD). In a non- extraction (of other teeth) case, a third molar extraction is essential Also, the extraction of the lower third Molar may be required to upright the mesially tilted lower molars.

**3) Study models**

Check points in study models in the finishing stages of treatment.
1. Relationship of marginal ridge.
2. Ideal arch form.
3. Canine relationship and overjet.
4. Overbite.
5. Aesthetic bends of anterior teeth.
6. Difference in left and right curve of Spee.
7. Torque.

1) Torque of upper canines: whether to increase or decrease.

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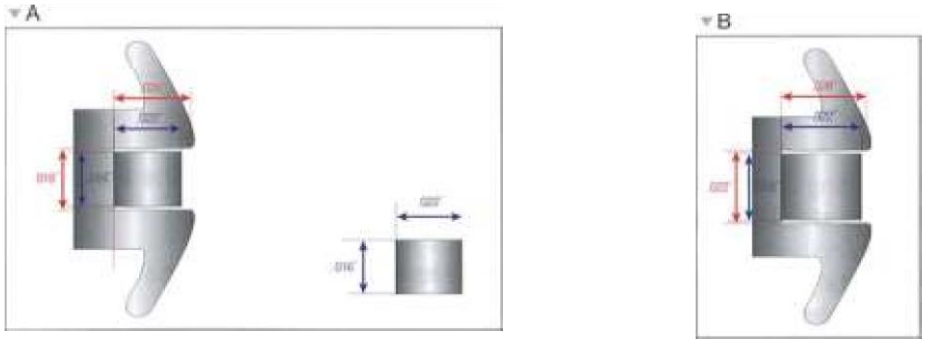
2) Torque difference of molars: upper and lower, left and right.[14]

**MEAW PRESCRIPTION**

The bracket size is .018" slot or .022" slot (fig -3). It is more desirable to use the .018" slot bracket.




.018" slot or .022" slot.

✓ If the bracket size is .018" slot, use the .016"x.022" stainless steel wires to make MEAW. ✓ If the bracket size is .022" slot in the SWA appliance, use the .018"x .022" stainless steel archwire to make MEAW and to prevent the impingement of gingiva in the posterior area.[15]

Shape of Standard MEAW can be divided into two:

**A) STANDARD MEAW**

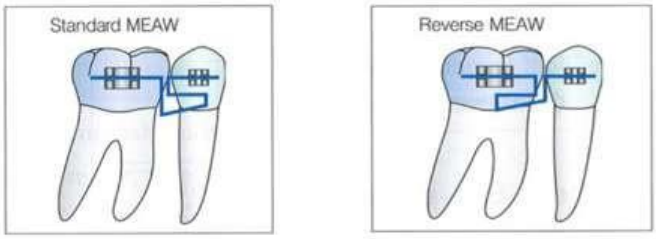



**Fig - 4** (a) Standard MEAW (b) Reverse MEA

Standard MEAW: usually used in open bite case

**B) REVERSE MEAW**

Reverse MEAW: severe overbite or if there is a deep overbite after space closures, the reverse MEAW is used.[16]

**ADVANTANTAGES OF MEAW**

(1) By reducing the load-deflection rate (LDR), a consistent orthodontic force can be continuously applied to the dentition.
(2) Although MEAW is a continuous archwire, individual tooth movement can be controlled easily because the horizontal loop and breaker control each individual tooth separately.
(3) Up-righting, extrusion, intrusion and torque control can be done with ease.
(4) The use of elastics long with the above actions can facilitate occlusal plane adjustment.[17]

**1) Records needed for the diagnosis:**

Below are the records needed for the case analysis of a patient with malocclusion.

l. Patient's dental history
2. Intra-oral photos
3. Facial profile photos
4. Panoramic radiograph
5. Cephalometric radiograph

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6. Diagnostic dental cast (mounted)
7. Record of condylar movement (axiograph)
8. Others: TMJ x-ray, MRI etc.

The basis for the morphological characteristics of the patient at this stage is not sufficient but can be substantiated by doing a cephalometric analysis

**Kim's method of analysis**

**1. ODI (Overbite Depth Indicator)**

Vertical types of malocclusion namely open bite and deep overbite conditions are used as in indicator. In ODI, the main element for measurement is the AB-MP angle. This angle is a reliable predictor of the malocclusion's vertical dimension. More specifically, there is a strong correlation of the vertical dimension of malocclusion and the lower facial area especially the adaptation of the mandible. Therefore, the angle measurement should be understood as a figure representing the correlation of skeletal adaptation in occlusal function.[18]

Two greatest factors which decreases ODI

*A. l. High angle open bite condition resulting from mandibular hyperdivergence*

2. Class Ill condition resulting from the anterior adaptation of the mandible

Either of these two factors may affect the vertical dimension of malocclusion. The critical factor in diagnosis is not whether a case is a low or high angle but the ability to identify the root cause of such situations is more important.

**APDI (Anteroposterior Dysplasia Indicator)** APDI, as the word implies, is the indicator of the anteroposterior relationship of the upper and lower jaw. It is a result of the statistical analysis of Kim where it determines the combination of the facial plane angle, AB-MP angle, and FH-PP angle which is geometrically equivalent to the PP-AB. PP-AB appears to be the antero-posterior relationship between the upper and lower jaws as a result. This needs no explanation.

**2) CF (Combination Factor)**

CF is a combination of ODI and APDI. CF represents the tendency of the mandible to open. A high CF indicates a tendency for low angle but when the CF is low, it shows the tendency for high angle. Dr. Kim claims that this serves as a sign to identify whether tooth extraction is necessary before receiving orthodontic treatment. Thus, when the CF is low, the need for tooth extraction is higher.[19]

**3) Denture frame analysis:**

Denture frame is the occlusal component of the basic facial skeleton which consists of the palatal plane in the basal plane of the maxilla, the AB plane in the anterior limit of the upper and lower jaw, and the mandibular plane (MP), known as the triangular pattern. The tipping of the occlusal plane and the vertical dimension in the functional plane of the occlusal system are directly related to the balance of this triangular pattern. Therefore, it is possible to find out the balance of the triangular plane by checking the relationship of the occlusal plane to the patient's characteristics.

**4) Occlusal plane and denture frame;**

Occlusal plane is the most important plane for the function ofthe masticatory organ. The mandible functionally adapts to this occlusal plane. Therefore, any change in the occlusal plane will affect the mandibular position as well as the balance of the denture frame. Characteristics of the denture frame are mentioned below

**1. Class III Malocclusion**

The occlusal plane is flat in class III skeletal pattern. Since the vertical dimension is excessively high, the mandible adapts through an anterior rotation resulting to Class III High Angle. However, when the vertical dimension is low with an anteriorly over-rotated mandible, the possible result would be a closed bite condition resulting to a Class III Low Angle. It is therefore important to understand clearly each patient's characteristics in creating a treatment plan.[18]

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**2. Open bite**

Open bite is divided into two major types, the Class III and Class II open bite conditions. The basic treatment method for each type varies. Consequently, it is crucial to distinguish one from the other. Class
III open bite is characterized by lingual tipping of the anterior teeth due to a flat occlusal plane while Class II open bite displays a posterior rotation of the mandible related to a steep occlusal plane.[19]

**3. Class Il Malocclusion**

The common type of class Il malocclusion is usually characterized by a steep occlusal plane. This type of Class Il problem, therefore, resulted from the failure of the mandible to adapt anteriorly.
The maxilla rotates anteriorly in patients with adequate occlusal support because of the excellent vertical expansion of the mandibular ramus. The occlusal plane, in this case, is flat.

**4). Lateral displacement of the mandible**

In patients manifesting a lateral displacement of the mandible, the occlusal plane on both sides usually differs. A steep occlusal plane is visible due to the mandible's displacement to the side. The TMJ also has a functional problem, which is typically on the side that is displaced. It is important to consider these factors in establishing a treatment plan.[18]

## LIMITATIONS OF MEAW

1. While comparing the MEAW method with the straight wire technique some limiting factors occur. Only a few minor skeletal changes have been found, and the dentoalveolar region showed the most treatment-related modifications.[16]This underlines the consideration that the MEAW technique is merely a compensatory treatment method as it has no significant impact on the skeletal structure.[20]
2. Although the MEAW appliance itself does not represent a risk factor, when used in combination with elastics for a prolonged period of time, the risk of root resorption is increased. If the application period exceeds 6 months, the incidence of root resorptions is the most severe.[21]
3. There is an elementary need for high patient compliance in order to obtain the accurate implementation of the MEAW technique and to avoid undesired side effects.[22]

## CONCLUSION

The MEAW technique appears to have significant therapeutic advantages and functions as a compensatory treatment modality in several types of malocclusion. The MEAW approach has a number of mechanical characteristics that make it easier to treat different malocclusions. It provides the opportunity to control each tooth individually through the use of mild, consistent forces. Challenging cases like open bite situation or skeletal class-III malocclusions with low to moderate severity can be effectively treated with this method.[23]
The most important issue in orthodontic treatment is the exact understanding of malocclusion and the diagnosis and treatment plan. Malocclusion itself cannot be treated without understanding its specific problems and treatment strategy. The majority of orthodontists are aware of the value of the MEAW technique, but it is noteworthy that the MEAW technique only produces a significant outcome when an accurate diagnosis and appropriate course of treatment are completed. However, the MEAW therapy little affects the basic skeletal patterns.[24]

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