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MEAW TECHNIQUE IN ORTHODONTICS – A REVIEW

Orthodontics

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KEYWORDS

INTRODUCTION:

Although the multiloop edgewise archwire (MEAW) approach was first developed to treat patients with open bites, it has quickly gained favour for treating a number of other malocclusions. Its fundamental idea is predicated on the theory that, by making use of the temporomandibular joint's flexibility, specific adjustments to the occlusal plane's inclination may be made to compensate for different kinds of malocclusions (1)

The MEAW (Multiloop Edgewise Arch Wire) technique was introduced over 40 years ago by Dr. Young H. Kim, an Orthodontic Professor at Boston University School of Dental Medicine. Dr. Kim came up with the technique of using a multi-loop wire to close open bites. Sadao Sato from Kanawaga Dental College of Japan acquired and publicized the MEAW concept further.

The preparation and activation of this appliance is complex but offers a maximum of flexibility and control to the practitioner.

MEAW arches have a perfect arch form, with five L-loops integrated in each quadrant beginning distally of the lateral teeth. They are constructed from 0.016″×0.022″ steel wire. Kim's initial recommendation for individual torque control was a bracket slot size of 0.018″. To recreate the complete occlusal plane, tip-back activations ranging from three to five degrees are used to manipulate the angulation of the posterior teeth (2)

According to the notion put forward by Kim and Sato, specific forms of malocclusions can be linked to the vertical position and inclination of the posterior occlusal plane because they directly affect the mandible's anteroposterior position (1)

A **steep** posterior occlusal plane is a common finding in **skeletal class II** cases, while a **flat** posterior occlusal plane is predominating in **class III** cases (1). In order to treat these cases the vertical inclination of the posterior region has to be corrected by flattening or steepening the occlusal plane respectively (2)

The so-called "molar-crowding," which is exacerbated by the collision of erupting third molars and the "squeeze-out" of the neighbouring molars, is thought to be the result of an evolutionary imbalance in the size of the entire alveolar base and all of the teeth (1) Because of this, the main measures of MEAW therapy are the elimination of the posterior crowding and the uprighting of mesially inclined posterior teeth as well as the reconstruction of the occlusal plane, implemented by corresponding activations of the MEAW appliance (1) Compared to the ongoing trend of technical advancement, the production of the MEAW appliance is more appealing since sophisticated extra components and intensive computer-aided planning may be dispensed with(3)

Structure And Function Of Meaw:

MEAW is an arch wire with horizontal loops positioned at the interproximal spaces of each tooth from the distal part of lateral incisors to the posterior teeth

- **Reasons for bending horizontal loops in the archwire are as follows :**
- Decrease the load deflection rate (providing a low but continous force on the teeth)
- An easier control of movement of each tooth
- Makes the alignment and intrusion of the supra erupted tooth as well as the torque adjustment easy
- With the aid of elastic it can reconstruct the occlusal plane

Fig-1

Horizontal Loop:

Horizontal loop – major part of the archwire
- relieves the vertical force and **regulates the vertical movement** of the tooth

Breaker – regulates **horizontal movement** of the tooth and simultaneously moves each tooth and detailing may be done as well
Loop base – regulates **tip back bends and torque control.**

Horizontal part of the archwire – this part **is inserted to the bracket** slot where the wire force is transmitted to the teeth.

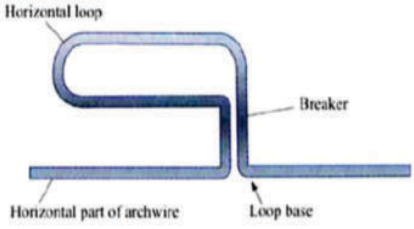

Fig- 2

For an ideal archwire with the horizontal loop, wire length is 2.3-3*length of the usual archwire This would decrease the orthodontic force by 1/5 and at the same time continuously apply orthodontic force to the teeth.

MEAW FUNCTION:

- It contains tip back bends ,
- Tip back bends varies from one patient to another depending on the treatment approach to the occlusal plane
- Each tooth 2-3°, entire dentition 15-20°

Modifications of MEAW:

- Different type of adjustments
- No adjustment
- Tip back bend
- Tip back bend for no occlusal change
- Continous step bend
- Partial step bend

During the treatment period, adjustment of the horizontal loop to a certain degree is possible when needed

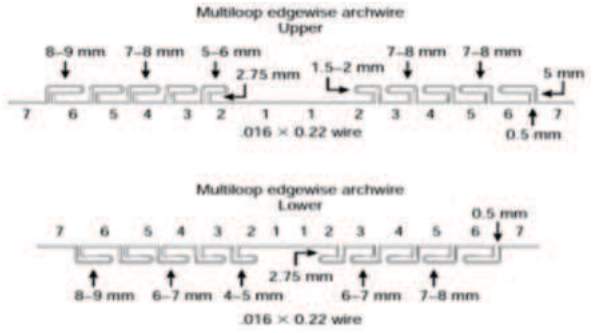

Fig- 3

MOAW (modified offset arch wire): When molar vertical control and correction are required, patients are treated with MEAW with offset in the premolar area. For individuals with class III high angle, crowding, and open bite problems, this is the initial course of therapy.

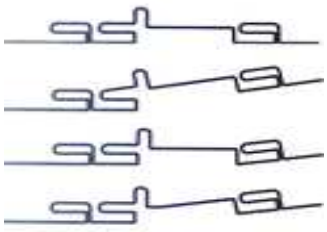

Fig-4

SMOM(Sectional modified offset with MEAW): The premolar and molar teeth can have vertical control applied to them when sectional MEAW is attached, whereas the teeth can have anteroposterior control applied to them when offset MEAW is applied. This can be utilised to provide occlusal support and anterior direction for the mandible in TMD situations including retruded mandibular positions.(1)

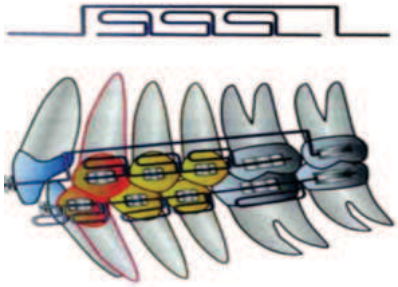

FIG-5

BENDING METHODS USED IN MEAW:

- MEAW consist of horizontal loop with an archform similar to the ideal arch used in the final phase of edgewise treatment

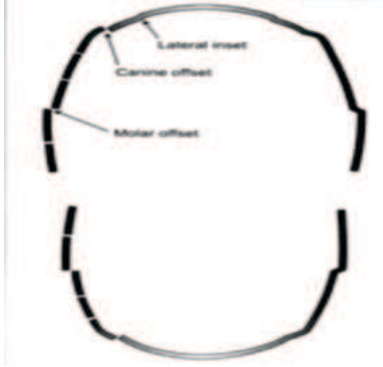

FIG-6

First order bend: bend in the horizontal direction of the dentiton , it includes the lateral inset , canine offset and molar offset

Second order bend: bend following the first order bend Horizontal loop is incorporated in this bend

Third order bend: passive and active torque to control tooth angulations

Passive torque : to prevent any changes to the angulations of the teeth .

Active torque : wire is twisted / bent to change the tooth angulations

Instruments needed in MEAW construction:

- O.016 *0.022 inch rectangular wire (S.S / Blue elgiloy)
- Arch turret
- Pliers
- Kim pliers
- Tweed pliers
- Nance pliers

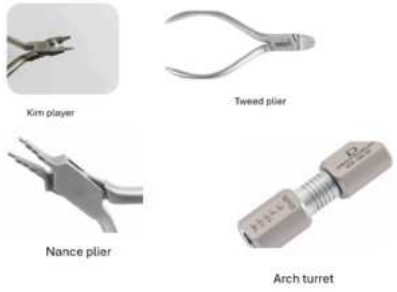

FIG-7

First order bend:
First we have to get the midline of the wire and with use of an arch turret create a mild curve in the anterior teeth

Then create an inset between the central and lateral incisors by marking the part to be bent and using a tweed plier, bend the wire inwards mesially and outwards distally bilaterally.
Determine the degree of inset at this stage

Second order bend (horizontal loop):

- Plier to be used in this procedure is the **KIM PLIER**
- Horizontal loop of the upper and lower wire is around 18-20 degree
- After placing the first order bend and horizontal loops in the archwire , it is important to have symmetry of the right and left side of the archwire

Third order bend (torque bend):
Use an arch former to determine the dentition's shape and a torque slot to twist the wire once MEAW has been bent and the torque for the full dentition has been planned.

In certain instances, torque adjustment is required while undergoing orthodontic treatment.
• There are basically 3 elements

1. Dental curve (first order bend)
2. Straighten the curve of the first order bend
3. Twist of wire

Create a little bend in the anterior section of the archwire to perform a labial crown torque in the anterior portion of the MEAW.Starting from the distal of the first loop, twist the wire inwards. The torque adjustment at this point should be determined by the strength of the curve. Next, firmly clamp the legs of the first horizontal loop, which are located at the distal surface of the lateral incisors. Bend the loop to straighten it vertically after it has tipped distally (5).

Heat treatment of MEAW:
Before the MEAW is placed into the patient's mouth, the wire is heated for five to ten minutes at 500 degrees Celsius using an electropolishing procedure to activate it. If a furnace is not available, an alcohol light can be utilised.Make sure the colour is uniform by heating the wire until it turns golden brown(1).

Adjustement methods used in MEAW:

- **Tip back activation**

Inorder to incorporate the tipback bends into the archwire , adjust the horizontal loop of the MEAW from a right angle to the acute Angle

- **Tip back deactivation**
- Deactivation is done by weakening the tip back bend when the alignment of the entire dentiton has been completed
- Tip back deactivation starts from where the tipback bends were placed
- **Step down bend**:
- To selectively extrude a tooth , MEAW is adjusted through a step bend .
- To do this expand horizontal loop using the plier and bend the anterior portion of the horizontal loop to lower the loop base
- To make a step bend during the treatment , insert the plier into the horizontal loop and create new permenant shape
- **Selective tooth intrusion**
- A step up bend can be done for selective tooth intrusion
- A step down bend is adjusted to its opposite direction to form a step up bend
- **Tip back bend without changing the occlusal plane**
- When aligning the tooth axis without changing the occlusal plane , step down bend and tip back bend adjustment can be done

- **Curve of spee:**
- At the last procedure of treatment , an A-P compensatory curve bend is placed to the dentiton

BIOMECHANICS

Vertical and horizontal tooth movement must be controlled in addition to achieving rotations and torque. The MEAW produces individualized movement of the posterior teeth and group movement of the incisors.

- The objectives of the loops can be characterized as follows:

I. The loops between the teeth significantly reduce the load deflection rate of the wire to as low as one-tenth of a 0.016 0.022-inch ideal arch wire.
II. The vertical components (anterior and posterior legs) of the loops serve as a breaker between the teeth and allow the teeth to move independently..
III. The horizontal components of the loops allow control of the vertical relationship of each tooth.
IV. The rectangular wire (0.016 0.022) provides torque control for each tooth, and the loops provide independent torquing tooth movement.
V. The tip-back activations in the posterior segment of the wire produce the uprighting movement of the posterior teeth.
VI. Fifteen degrees of molar uprighting produce as much as 4.5 mm of distalization
VII. Along with the tip-back activations, anterior vertical elastics correct the occlusal planes and, in turn, close the open bite**.**

Patient evaluation and treatment plan:

I . Records needed for diagnosis :

I. patients dental history
II. Intra oral photos
III. Facial profile photos
IV. Panoramic radiograph
V. Cephalometric radiograph
VI. Diagnostic dental cast
VII. Record of condylar movement (axiograph)
VIII. Others:- TMJ x ray, MRI (1)

II. KIMS method of analysis

- ODI (Overbite depth indicator)

Used as an indicator of the open bite and deep bite disorders, two vertical forms of malocclusion .The AB-MP angle (75.8 degrees) is the primary measuring factor. An open angle suggests a deep bite, whereas a closed angle indicates an open bite.

The two main factors that lower the ODI are:
Mandibular hyperdivergence-related high angle openbite syndrome
Class III condition caused by anterior mandibular adaption

- **APDI** (ANTEROPOSTERIOR DYSPLASIA INDICATOR)

It is the A-P relationship of the upper and lower jaws.

- There are 3 parameters to determine APDI
- FH-FP = Avg 87+_ 3 degree (open – prognathic mandible, closed – retrognathic md)
- FP=AB PLANE {negative class II, positive Class III}
- FH-PP -2 degree

-ve – palate is tipped upward and forward
+ve – palate tipped downward and forward

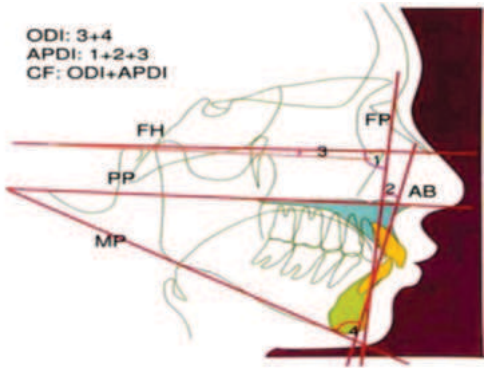

FIG- 8

CF(combination factor)

- CF is combination ODI and APDI represents the tendency of mandible to open

High CF – tendency for low angle
Low CF – tendency for high angle
According to kim , this serves as an indicator to determine the need for tooth extraction prior to the orthodontic treatment (155.9 degree)
Ie, when CF is low the need for tooth extraction is higher

III. Denture frame analysis

Established in 1987, the Denture Frame Analysis (DFA) facilitates the rearranging of occlusion within the parameters of a certain "denture frame" by assessing the skeletal position.(4) The foundation of DFA is the relationship between overbite and overjet levels and cephalometric parameter correlations. Because MEAW and DFA are based on average values, they provide metrics of patient-individualized treatment planning and implementation, in contrast to the widely used straight-wire methods.(5)

Compared to treatments utilising the Ideal Achwire (IA) without loops, a mesiodistal tipping movement during MEAW treatments results in a more equal distribution of stress and less displacement of individual teeth.(6)

Together with the MEAW device, the anterior vertical elastics transform the forces brought on by the tip back bends into the intended motions(7) The Overbite Depth Indicator (ODI), the Anteroposterior Dysplasia Index (APDI), and the Combination Factor (CF) are the three distinctive values.(8) By determining the inclination of the maxillary and mandibular bases and describing their connection in the horizontal dimension, the ODI is used to characterise the vertical development pattern(9)

- Denture frame is the occlusal component of the basic facial skeleton which consist of:Palatal plane in the basal plane of maxilla ,AB plane – anterior limit of U &L jaw ,Mandibular plane (MP),All these together is known as triangular pattern.(10)
- Balance of this triangular pattern is related to the tipping of occlusal plane and the vertical dimension in the functional plane of occlusal system.

IV. Occlusal plane and denture frame

- Occlusal plane is most important Plane for the function of masticatory organ.Mandible functionally adapts to this occlusal plane. Therefore, any change in occlusal plane will affect the mandibular position as well as the balance of the denture frame. These are the charecteristics of denture frame

Class III Malocclusion:

- In class III skeletal pattern Occlusal pattern is flat
- Since the vertical dimension is excessively high, mandible adapts through an anterior rotation resulting to class III High angle
- 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

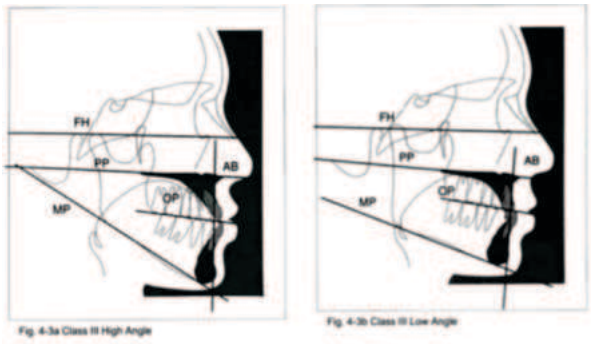

Fig. 4-3a Class III High Angle Fig. 4-3b Class III Low Angle

FIG- 9

Open – bite:

- Open bite is divided into two major types ie, class III and class II

Basic treatment method for each type varies,Therefore , it is very important to distinguish one from the other

- Class III openbite is charecterized by lingual tipping of the anterior teeth due to flat occlusal plane while class II openbite displays a posterior rotation of the mandible related to a steep occlusal plane

Class II Malocclusion:

- common type of class II malocclusion is usually charecterized by a **steep occlusal plane** .This type of class II problem , therefore resulted from the failure of the mandible to adapt anteriorly .In patients with sufficient occlusal support due to the excellent vertical growth of the mandibular ramus , the maxilla rotates anteriorly allowing the occlusal adaptation .Occlusal plane in this case is flat

Lateral displacement of the mandible:

- In patients with lateral displacement of the mandible , the occlusal plane on both sides usually differs
- The mandible is displaced to the side where a steep occlusal plane is evident
- There will be functional disorder of the TMJ usually on the displaced side

DISCUSSION:

However, MEAW treatment has very little effect on the fundamental skeletal patterns(3). According to Chang et al., the cephalometric values of the MEAW patient group are relatively similar to those of the control group, indicating that the adjustments brought about by the MEAW device are similar to the dentoalveolar compensatory mechanism that occurs naturally(3). Because the dentoalveolar area experiences the majority of treatment-related alterations, MEAW acts as a camouflage treatment strategy.(6) While it does not completely remove extensive skeletal deficits, it offers a minimally invasive dentoalveolar compensatory technique(11)

CONCLUSION:

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(12). This technique is also indicated for younger patients not old enough for jaw surgery who wish to correct their bite and restore normal growth pattern. Multiple mechanical characteristics of the MEAW approach make it easier to address different kinds of malocclusion. It provides the opportunity to apply consistent, mild force to each tooth individually. difficult conditions such as skeletal class III malocclusions with low to moderate(3)

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