REVIEW ARTICLE

Dentoalveolar Expansion In Mandible - A Review Article

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Abstract:
Malocclusion, in particular the tooth size-arch length disparity (TSALD), is a typical orthodontic treatment difficulty that has important consequences for extraction choices, particularly when it comes to the mandibular arch. In line with current conservative treatment trends, more conservative techniques such distalization, arch expansion space gaining, and interproximal reduction are now recommended over extractions. Mandibular expansion largely affects the alveolar bone, and unlike the maxillary arch, where rapid expansion can separate sutures, it frequently results in tooth inclinations rather than persistent transverse dimension alterations. In spite of this, new research challenges long-held notions regarding the instability of mandibular arch widening and suggests that it can be achieved permanently.In order to fill a vacuum in the orthodontic literature and advance knowledgeable clinical practices, this review attempts to clarify the numerous mandibular expansion devices and their activation mechanisms.

Keywords: Dentoalveolar expansion, Mandible, Malocclusion

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INTRODUCTION:

For many orthodontic patients, a tooth size-arch length discrepancy is the most prevalent kind of malocclusion. The decision to extract is greatly affected by this discrepancy, particularly in the mandibular arch. It is preferred to utilize techniques like distalization, arch expansion space gaining, and interproximal reduction given the current move toward more conservative treatment modalities.[1]

Edward Angle was the one who was against extractions as an essential part of treating orthodontic patients, and the controversy continues till today with no clear a potential remedy. The absence of sutures in the mandible sparked a contentious debate regarding extraction vs non-extraction. Contrasting to the rapid expansion of the maxillary arch, that separates the sutures, the effects of mandibular expansion tend to be restricted to the alveolar bone and primarily result in tooth inclinations if there is an increase in transverse dimension. Nonetheless, some researchers contend that appliance therapy is unable to alter the form of the mandibular arch and that mandibular expansion is not conceptually stable. This is being demonstrated through certain studies that it is possible to permanently widen the mandibular arch.[2]

According to Hadelman, the mandibular arch's contemporaneous rule of expansion was used when the inter-premolar and inter-molar widths were less than 25 and 34 mm, respectively.

Walter claims that it is possible to permanently alter the mandibular arch's width. Mandibular expansion as grown becoming more prevalent over the last few

years. There was a discernible decrease in crowding, a discernible rise in dental arch widths, and even long-term stability following mandibular expansion therapy. Not all orthodontists are aware of the existence of orthodontic appliances, despite the lack of evidence in the current orthodontic literature promoting their use to achieve mandibular expansion. This article's goal is to list these appliances along with their activation processes.[1-3]

The few mandibular expansion tools or appliances used to alter the mandibular arch's transverse discrepancy are listed below.

1) Schwartz appliance[4,5]

In 1966, Shwartz introduced the Shwartz appliance. It is mostly located in the mandible and is a detachable expansion plate. It is recommended to use the appliance in the mixed dentition stage. The appliance is basically an acrylic plate with a midline split that includes one or two expansion screws; neither the occlusal surface nor the incisal borders are covered by the acrylic.

Additionally, the appliance features a labial bow and is fastened with either an Adam's or a ball end clasp. Patients with aberrant lingual inclination in their posterior teeth or those with inadequacies in arch length can benefit from the use of the Schwarz appliance.

Activating the midline screw causes the Schwarz appliance to gradually expand, which only tilts the posterior teeth laterally.Rapid maxillary expansion then ensues, stabilizing mandibular dentoalveolar position for the duration of the retention period.

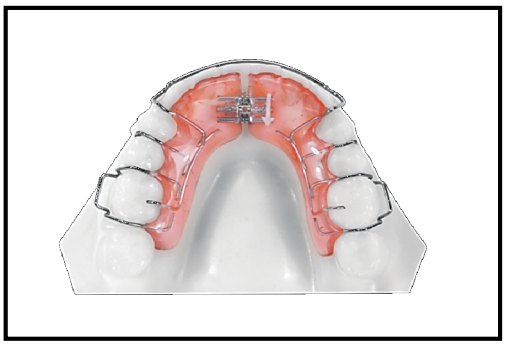

Fig.1 Schwartz appliance

Activation protocol Until the screw reaches its maximum extension before the completion of the treatment, the activation is done at a rate of roughly 1/4 turn each week. It is advised to wear the appliance for at least 14 hours per day.

2) Lip bumper[6,7]

The mandibular dental arch can extend transversely and anterior-posterior thanks to the lip bumper. It is made of 0.04500 stainless steel wire and usually extends from molar to molar in the mandibular dentition.

The wire is normally placed close to the gingival margin, and slightly away from the labial tooth surface, and it may or may not be covered anteriorly with acrylic or plastic. The appliance has adjustment loops directly above the lower molar tubes, which it is made to fit into.

Fig.2 Lip bumper

Activation protocol

The lip bumper prevents the tongue's pressures on the lingual surface of teeth to remain unbalanced, which leads to mandibular dental arch forward and lateral expansion. Additionally, it moves the facial muscles so that they are not in contact with the lower teeth.

The basic idea behind the lip bumper is to upset the balance that surrounds the teeth.

3) Williams' expander[3]

Williams created this fixed appliance to address early mixed dentition crowding. This device is made up of two long stainless-steel tubes this stainless-tube were soldered to the lower primary second molar bands on each side. The tubes extend back to link the first permanent molars' linguals. By extending the wire over the front of the jaw, an expansion screw is fastened to the molar bands. The 0.016 NiTi arch wire is inserted anterior ends of the stainless-steel tubes, and upon activation of

the expansion screw, the NiTi wire is automatically drawn forward to alleviate incisor crowding.

Modifications:

a. **Modified williams expander**
The 0.016 NiTi archwire arc is absent in the modified Williams expander, which else resembles the original design. The arms of the expansion appliance are in line with the occlusal line on the cervical third of the premolars.

b. **2-arm mandibular fixed lateral expansion appliance (FLEA).**
According to Leone, Italy, the expansion screw contains two 0.060-inch extension arms and two first molar bands. A 0.035-inch wire was soldered to these arms to give it the required length, allowing the wire to protrude 2.0 mm from the alveolus. The wire reaches below the mid-crown level of the first and second premolars in order to minimize tissue injury.

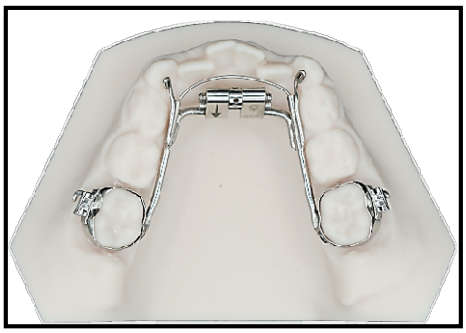

Fig.3 William's expander

Protocol of Activation
A quarter turn of the screw, or around 0.25 mm, should be applied once every two weeks to achieve 0.5 mm of weekly growth.

4) Trombone appliance[8-10]
Purpose of the trombone appliance is to support the development of the antero-posterior dimension in the mandible and maxilla. The trombone appliance has great potential for adult treatment because it doesn't impede speech and can be incorporated with traditional fixed appliances.

The appliance's construction is works on the slide principle, in which an innermost tube slides free in an outermost tube to change the device's length. This mechanism is reminiscent of the slide trombone, from which the appliance gets the name. The appliance's molar section is held in place by double lingual supports, and it has a vertical tube attachment that allows the trombone piece to be inserted.

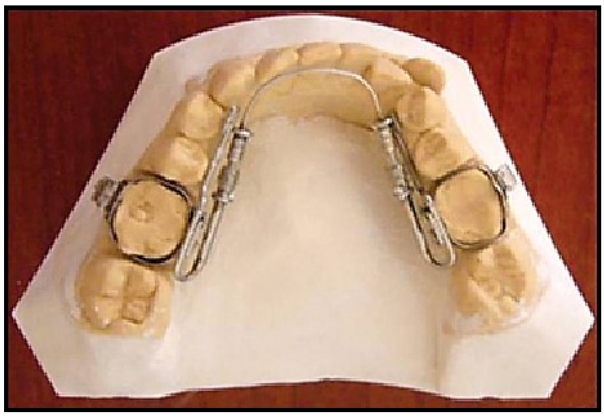

Fig.4 Trombone appliance

Activation protocol
For accomplishing the necessary first expansion, the device is to be preactivated. Every four to six weeks, the mechanism is reactivated by inserting a new, suitably longer silicone tube in place of the old one. Until the arch's shape is fixed.
In order to contact the anterior region of the lingual arch, the distal portion of the wire is recurved and held in a horizontal sheath on the molar band, which extends mesially at the gingival level. Using light, controlled lingual forces, rapid tooth movement is possible due to the lack of frictional forces.

5) TORKO Appliance[11]

This particular micro expansion screw is intended for use in orthodontic therapy. "TORKO" appliances were LEONE's first mono guide, sanitary expansion. TORKO screws are designed to keep food particles, debris, and plaque out of mandibular hygiene equipment since they have a precise torque and don't have any welding marks

Fig.5 TORKO appliance

Activation protocol
The appliance encouraged sagittal and transverse dentoalveolar expansion by applying the proper amount of translingual tension. In the morning and evening, the appliance is turned on for one-quarter of a turn. It causes a daily enlargement of 0.4 mm. To reach 11 mm of growth, this method is done every day for an additional 28 days**.**

6) Mandibular Arnold Expander[1,12,13]
Berkowitz made the Arnold appliance widely known. In order to accomplish gradual, orthopaedic maxillary growth in patients with cleft palates, a fixed coil-spring device was developed in the 1970s. By tilting the buccal teeth and distalizing the first molars, the Arnold appliance can provide a 4e5 mm gap in the mandibular arch.
The apparatus consists of a split lingual frame with a wire insert and a 0.04000 tube on opposite sides. An open-coil spring composed of 0.01000 Elgiloy or 0.040" nickel titanium connects the two sides.

Modification
Dr. James Thacker's adaptation of the classic mandibular Arnold expander, with a mesial stop for an open-coil spring and an occlusal rest for deciduous molar teeth.

6.a For distalization
Instead of producing transverse expansion, the lingual frame of the expander is raised above the occlusal table, resulting in molar distalization.

Fig.6 Mandibular Arnold expander

Protocol for Activation
When the device is seated, the spring is compressed and ready to expand. No additional modifications or turning of the expansion key are required.

7) TransForce Arch Developer[9,14]
TransForce is a collection of preassembled, undetectable lingual devices used to develop the transverse and sagittal arches. Encapsulated nickel titanium springs produce light, biological forces that produce positive outcomes for patients of all ages, from adult therapy to targeted treatment in a dentition that is mixed.
Throughout the course of therapy, this gadget can be used in tandem with any conventional fixed appliances. This approach reduces the amount of time spent in a stationary appliance and is efficient and economical, especially for adult patient therapy.

Fig.7 TransForce arch developer

Activation protocol

This method is applied to many appliances for the development of the sagittal and transverse arches, and it is not necessary to activate the appliance after it is put.

8) Beta-titanium auxiliary expansion arch wire[9,15]

The mechanical characteristics of betatitanium wires, such as their low stiffness and resilience, were used to develop an additional overlay arch in the maxillary and mandibular arches for dentoalveolar expansion.

In order to fit within the 0.016 X 0.022" NiTi thermos arch wire, a straight 0.03200 beta-titanium wire with tear-form hooks on both ends was used to make the TMA-EA. In order to cause the dentoalveolar process and the NiTi thermo arch wire to retract in the buccal region, the TMA-EA was kept as a straight segment rather than curled into an arch shape. To determine the length of the TMA-EA, the circumference between each mesial entrance of the molar tubes was measured.

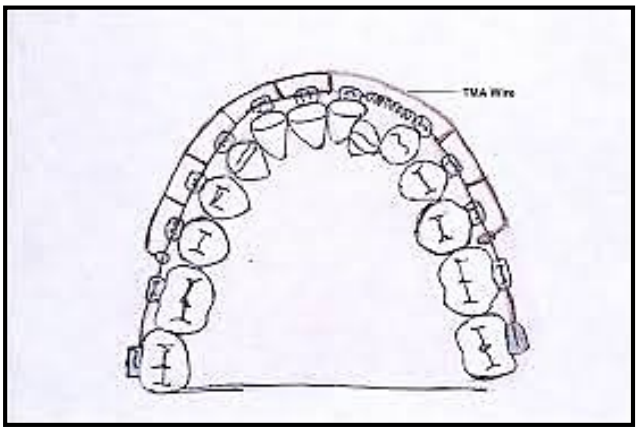

Fig. 8 Beta-titanium Auxiliary Expansion arch Wire

Protocol for Activation

To strengthen the TMA-EA, three stainless steel ligatures were positioned in the premolar and central incisor areas. At every visit, the gadget was taken out and adjusted. The TMA-EA was used for sixty days, or until the transverse relationship was overcorrected.

9) Bi-helix expander[1,3.9,16]

The lower arch's Bi-Helix Expander works well to develop the arch and bring the molars into an upright position at the same time. It is a practical and efficient tool that opens up the lower jaw. The most noticeable posterior teeth are bonded to the helix coils, which are used and positioned lingual to the molars to achieve this. Patients are also more comfortable when the anterior helixes are absent.

Modification

9.a A 0.9 mm-diameter cobalt-chromium wire was utilized to increase the anterior arm's stiffness. The mandibular arch was forced using the Bi-helix appliance, causing a shift of 2.0 mm every three months.

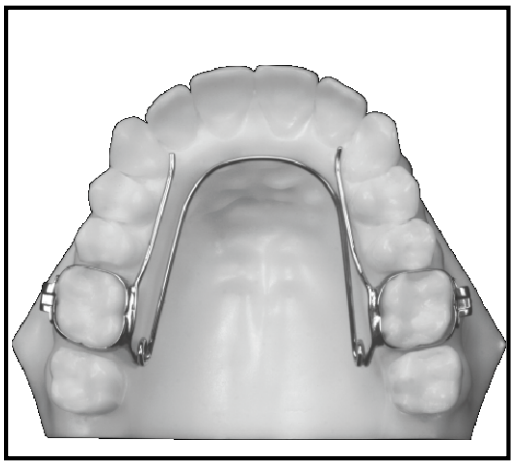

Fig.9 Bi-helix expander

Protocol for Activation

Before cementation, the 2-M band can be stretched apart to pre-activate the bi helix. Alternatively, three-prong pliers can be used once cementation has occurred at the expander's lingual bridge.

DISCUSSION

When a growing person experiences TSALD or mandibular constriction, a mandibular expansion is frequently carried out. However, the early fusion of the mid-symphyseal area limits it. This essay made an effort to showcase the several mandibular dental arch extension devices that are available. With the Schawrz appliance, dental crowding in the

permanent teeth is addressed. Commonly, severe deficit arch length is used to specify it.[17-21]

Since frequent activation is necessary, the outcome primarily depends on the patient's cooperation. When a late mixed dentition patient exhibits hyperactive mentalis activity, lip bumper enlargement is more appropriate. Additionally, it aids in lip trap correction. Even prior to the eruption of the first permanent molars, crowding in the early mixed dentition is substantially corrected by William's expander. It will result in weekly enlargement of roughly 0.5 mm.[21,22]

Trombone appliances are more helpful whenever expansion is required in three spatial directions, like in Class II division 2, to correct maxillary and mandibular arches. The circumference of the mandibular dental arch grows by 7.4 mm. For patients who are growing or adolescent, any collapse in the inter-canine width makes the TORKO device more appropriate. Its principal mechanism of action is dentoalveolar enlargement. Patients with moderate TSALD are typically treated with Arnold expander from early interceptive to late adolescence. All in all, Arch development using trans-force lingual appliances are typically patient-friendly because they don't need to be activated once they are installed.[9,21] The degree of malocclusion, patient compliance, and age all play a role in the appliance choice for mandibular expansion.

Retention protocol[9,17]

- A fixed lingual arch appliance or the same appliance used for mandibular expansion can be employed as a retention tool.
- Three to six months is the recommended retention period after reaching the optimal expansion.
- This nonsurgical expansion method can successfully accomplish mandibular expansion in a large number of adult patients with transverse mandibular insufficiency.

CONCLUSION

There are multiple appliances that can be used for mandibular arch expansion. Every one, nonetheless, has unique benefits and indications. Every patient has a different appliance preference, which is crucial for a successful course of treatment. The type of appliance selected and the dentition's stage of development were the primary determinants of the amount of expansion attained.

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