MAXILLARY EXPANSION APPLIANCES: REVIEW

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ABSTRACT:
The increased sutural and skeletal response has been related to growth periods of high-cellular activity. In conjunction with the enhanced response to maxillary expansion, early treatment appears to allow the use of less complex and lower-force expansion systems to achieve increase in maxillary arch width. Slow expansion appliances effectively increase maxillary width with a combination of orthopedic and orthodontic components during deciduous and mixed dentitions. Older patients require higher force systems of rapid expansion or surgical intervention to achieve palatal separation.

INTRODUCTION:
The word “expansion” refers to lateral enlargement of the dental arches by Orthodontic forces. Transverse expansion of the maxilla has been used by orthodontists for more than 100 years to correct maxillary anomalies. One of the first objectives in orthodontic treatment is the correction of skeletal or dental discrepancy in the transverse dimension. The applied pressure acts as an orthopedic force that opens the midpalatal suture. The appliance compresses the periodontal ligament, bends the alveolar process, tips the anchor teeth and gradually opens the midpalatal suture. The void created by the opening of the mid palatal sutures subsequently filled with new bone. Rapid maxillary expansion is orthopedic rather than orthodontic in nature. Slow expansion has been shown to produce both orthopedic and orthodontic changes.

DIAGNOSTIC CRITERIA:
Expansion across the suture can be done in two ways 1) Rapid expansion and 2) Slow expansion. The object of maxillary expansion is to widen the maxilla, not just expand the dental arch by moving the teeth relative to the bone.

Indications for Expansion:
1. Maxillary deficiency.
2. Bilateral maxillary constriction.
3. High and narrow palate.
4. Septal deformity.
5. Maxillary collapse (cleft palate).

Contra-indications for Expansion:
1. True unilateral crossbite.
2. A person showing soft tissue pathology in the pressure bearing areas.
3. If maxilla is narrow and long and is associated with mandibular retrognathism.
4. Crowding per see is not an indication as little space is obtained by expansion.

Advantages of Slow Expansion:
1. Low magnitude of force.
2. Does not require patient control.
3. Uses intermittent or continuous force upto 2-4 pounds.
4. Rotate molar.

Disadvantage of Slow Expansion:
1. Lengthier treatment time.
2. Mostly dento alveolar changes.

Advantages of RPE:
1. The expansion will always be greater in the anterior part of the suture.
2. Palatal widening improves air flow through the nose as an aid to mouth breathers.
3. The technique is best suited for mixed or early dentition.

Disadvantages of RPE:
1. High magnitude of force causes separation and takes long time for bone to fill in.
2. Requires patient control.
3. Problem with speech.
4. Non-hygienic, very bulky.
5. Does not rotate molars.

APPLIANCES USED FOR MAXILLARY EXPANSION:
The Schwarz Appliance:
The upper Schwarz appliance consists of an active plate of acrylic custom fit to the palate leaving the incisal and occlusal surfaces of all the teeth exposed. It is split longitudinally down the middle and is joined by one or two expansion screws,
The Wilson series of all wire 3D appliances show not only a strong Porter-Crozat type heritage but also reflect certain Mershon influences as well. The Wilson-type lingual arches are of lighter and resilient wire. The pentagonal wire loops are incorporated into the mandibular appliance to gain steady & active force.

The Wilson appliance is also made of the .036 wire in the body portion tapering to .025 in the lingual arms. The appliance is adjusted using a Jarback pliers inserted into the appropriate helical loop acting as the vice and applying finger pressure to the arms and body wire.

The counter part to the quad-helix palatal appliance for the mandibular arch is the Wilson 3D quad-action mandibular appliance. The Adaptor portion of the arch rests against the cingulae of the anterior mandibular teeth. The activator loop is offset lingually slightly to avoid gingival impingement. Friction lock of the two posts that make up one attachment mechanism. The portion of the lingual arch extending distally from the friction lock is .025 diameter wire and is referred to as the extender.

The quad-helix is a fixed expansion spring normally used in conjunction with other appliance system. It has evolved from the W spring used in a removable appliance originally described by Coffin. (Coffin 1881) W type springs were attached to upper first molar bands. While Ricketts increased the flexibility of the spring by adding posterior and anterior helices. The appliance produce both orthodontic and orthopaedic movement.

The appliance was made of cast, eblech nickel chromium, which has a high resistance to breakage and torsion and could be used in a thin enough layer to fit between the palatal gingiva and the teeth. The three parts of the appliance were cemented with a glass ionomer. Allen screws in preference to flat head screws.

The appliance combined with Nickel chromium Herbst have several advantage. The banded nickel chromium herbst is more durable than the banded acrylic varieties. The problems encountered were loose screws, disengaged rods, break in weldings, microleakage, broken appliance, loose bands and broken screw heads.

**CONVERTIBLE HASS-TYPE RAPID PALATAL EXPANDER**

Hass designed a rapid palatal expander appliance that used acrylic pads to apply pressure to the relatively ischemic areas of the palatal mucosa between the first premolars and first molars. The appliance was left in position for three months, thus acting as a fixed retainer. Zimring and Isaacson suggest that six weeks of retention is sufficient to establish an equilibrium between the contiguous sutural articulations. The convertible RPE was designed to reduce chairtime, eliminate laboratory procedures and maximize stability of the bony segments during treatment, it is more hygienic and less likely to irritate the palate.

**NICKEL TITANIUM PALATAL EXPANDER**

Wendell V. Arndt developed a tandem loop, nickel titanium, temperature — activated palatal expander with the ability to produce light, continuous pressure on the midpalatal suture while simultaneously uprighting, rotating and distalizing the maxillary first molars. This fixed-removable appliance has adjustable stainless steel extension and is inserted into standard horizontal lingual sheaths that are spot welded to the molar bands.

At temperature below the transition temperature the interatomic forces weaker, making the metal much more flexible, above the transition temperature the inter atomic forces bind the atoms tighter and the metal stiffens. The nickel titanium expander has a transition temperature of 94F when it is chilled before insertion, it becomes flexible and can easily be bent to facilitate placement. As the mouth begins to warm the appliance, the metal stiffens, the shape memory is restored and the expander begins to exert a light continuous force on the teeth and the mid palatal suture. This expander generate forces of 180-300g.

**PALATAL EXPANSION WITH A NEW TWIST- LARIAT PALATAL EXPANDER**

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Modifications: Increased number of helices, decreased number of helices, addition of light wire springs, and addition of habit breaking auxillaries.

**FULL COVERAGE BONDED RME APPLIANCE**

This appliance was fabricated by John L. Spolyar in 1984. The appliance design incorporates the use of a spider-type rigid expansion screw to deliver the mechanical force for lateral maxillary displacement. The prepared expansion screw is then held with cold-cure acrylic at the inverted U interface to the model to eliminate wire undercuts and create an area of attachment. The appliance is cut out and trimmed back to the gingival margin.

In each phase 4 to 5 of screw opening is used, with a resting period of 6 weeks between phases; these phases are repeated until the desired amount of expansion is reached.

**THE MODULAR PALATAL DISJUNCTOR APPLIANCE**

The modular palatal disjunctor appliance was fabricated by Dr. Jean Luc Pru Vost.

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**PALATAL EXPANSION WITH A NEW TWIST:LARIAT PALATAL EXPANDER**

Jeffrey J. Staples developed the lariat palatal expander which reduces or eliminate all the limitations or traditional expanders,
without affecting the expanders basic attributes of size, strength and reliability. The lariat can be made in either an acrylic or a metal version. Activation is accomplished with a 3" Allen wrench that is inserted in the front of the expander and turned from outside the mouth. Chair side time is reduced because minimal instruction is needed. The new expander offers a simple, clean and safe alternative.

A NEW TELESOPIC MAXILLARY EXPANDER
Lewis Klapper and Richard Georgese developed the telescopic expander, the super screw, with three overlapping parts. This expander makes it possible to achieve 2mm of expansion for every 1mm of screw length. The hex sleeve allows front activation with a wrench and eliminates the traditional four-hole Capstan. The super screw has a scale that allows an instant visual determination of the amount of expansion. A warning thread on the scale that indicates when the limit of activation has been reached. An optional locking nut reduces the total expansion capability to 15mm and increases the overall length of the super screw to 17.5mm, particularly useful for slow expansion. The super screw is more hygienic than other expanders.

A FIXED APPLIANCE FOR MAXILLARY EXPANSION MOLAR ROTATION AND MOLAR DISTALIZATION
David J.Snodgrass developed a fixed rapid palatal expander that incorporates the rotation and distalization components of the pendulum appliances. It can be used in the mixed or permanent dentition as an adjunct to the treatment of mild class 11 malocclusion.

Appliance design: The metal frame of the appliance consists of an 11mm expansion screw, occlusal rests, and two .032" TMA Pendulum springs. The screw and springs are embedded in acrylic, the spring are doubled back for insertion into .036" tubes that are spot-welded to the maxillary first molar bands. The expansion screw is soldered mesial to the molar tubes. The acrylic includes a broad Nance button for anterior anchorage during distalization

Activation: The screw is activated twice a day until the desired expansion is achieved. The springs are activated by cutting the mesial solder joints on the maxillary first molars. The appliance reduces treatment time by combining maxillary expansion, molar rotation and molar distalizations with out need of patient co-operation.

DISCONNECTABLE RAPID PALATAL EXPANDER
Dr. Bonetti, Dr. Marini and Dr. Rizzi developed the disconnectable expander with .032" square wires that are inserted into the .036" square slots of twin bicuspud and molar brackets, which are welded to the lingual of molar and bicuspid bands. The appliance should be constructed with the screw opened about 2mm, so that it can be removed simply by turning back the screw. The bands should be cemented in place with appliance tied into the bracket slots. The disconnectable RPE can be used in cases of large transverse discrepancy or in surgically assisted rapid palatal expander.

RETENTION
Retention of cases of lateral development is important due to the amount of tissue and other structures moved during active therapy. The farther the teeth must be moved laterally and the more rapidly they are moved, the longer should be the period of retention.

The amount of retention needed for a given case is dependent on many factors. Most cases should remain in active retention atleast 6 months.

The first is the age of the patient. The younger, the greater the chances of stability in lateral development. In older patients the problem becomes a little more difficult.

BIBLIOGRAPHY