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INTRAORAL APPROACH TO MOLAR DISTALIZATION: A REVIEW

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ABSTRACT

To extract or not to extract has been a ley question in past for decades. Traditional upper molar distalization techniques require patient co-operation with the headgear or elastics. Recently, several different intraoral procedures have been introduced to minimize the need for patient co-operation. The correction of Class II malocclusions has been hampered by the use of appliances which require the patient to co-operate with headgear, elastics, or the wearing of a removable appliance. 'Non-compliance therapy' involves the use of appliances which minimize the need for such co-operation and attempt to maximize the predictability of results. This article reviews and describes the types of appliances used, and their mode of action-based on the current available research.

KEYWORDS: Distalization; intraoral; malocclusion

INTRODUCTION

The omnipresent question faced practically every time the orthodontists do a treatment plan for the patient, "Do we need to extract teeth or can the necessary space be created without extractions." In the adult patients there is no clinically significant growth in the bone structure; therefore, alternative solutions must be found to obtain space in which the teeth can be moved, to correct the malocclusion. Edward Angle,[1] the "father of modern orthodontics," set a non extraction tone to treatment. He believed that when teeth could be corrected by other modalities, extraction of teeth for orthodontic purpose seemed particularly inappropriate and unacceptable. According to Moyers (1988)[2] the nonextraction treatment modalities for Class II cases resulted where the malocclusion is due to aggravation of dental symptoms and has anterior posterior and vertical skeletal imbalance requires maxillary molar distalizaiton to achieve class I molar and canine relationship. The emergence of various modalities of molar distalization has given new meaning to the non-extraction treatment. These appliances have improved our treatment options considerably over the past few years.

CLASSIFICATION (Table 1)

1. Location of appliance
Extra-oral
Intra-oral

2. Position of appliance in mouth
Buccal
Palatal

3. Type of tooth movement
Bodily movement
Tipping movement

4. Compliance needed from patient
Maximum compliance
Minimum or No compliance

5. Type of appliance
Removable
Fixed

6. Arches involved
Intra-arch
Inter-arch

7. Appliances used
Maxillary
Mandibular

Various non-compliance modalities to distalize molars

Each orthodontist can adhere strictly to a system of orthodontic mechanics and achieve satisfactory results in cases to which system is adapted. However the diversity and complexity of orthodontic problems demand a whole spectrum of appliance function not to be found in any of the single appliance. The concept of the so-called "pure" appliance historically has proven to be an illusion and enforces restrictive treatment concepts. Appliance systems which are designed to produce distal movement of first molars have been available for over a century. Several methods are known to cause molar distalization, none of which work for all patients in all situations.

Herbst Appliance

The Herbst Appliance as originally designed by Emil Herbst in 1905[5] based on the idea of jumping the bite and popularised by Pancharz,[4] attempts to address these problems of patient cooperation and control of the direction of mandibular growth stimulation. Research to date has shown that the Herbst appliance has the ability to inhibit maxillary Anteroposterior growth and to produce an increase in mandibular length and lower facial height.[5-7] It has been reported that in many cases, Herbst appliance therapy results in approximately equal amounts of dental and skeletal changes. The dental changes reported have included distalization of the maxillary molars and mesial movement of the mandibular molars and incisors. In 1989, John R Valant[8,9] used same design and extracted upper second molars for distalizing of the molars and he found that 10mm of increase in arch length. On cephalometric analysis he found that bodily molar distal movement of the molars had taken place.

Saif Spring

The first clinically useful interarch force system was the developed by Armstrong. In the late 1960 or early 1970s, Armstrong introduced the pace spring, later termed Multicoil spring, and finally called Saif Spring (Several adjustable intermaxillary force).[10, 3]

NiTi Interarch Spring

Niti interarch spring[3] was introduced by GAC International in the early 1990s, with the expectation that the low force and high flexibility of the nickel titanium alloy could overcome the breakage problems of the Saif Spring. But the low fatigue resistance of these alloy resulted in a breakage frequency comparable to that of the Saif Spring.

Jasper Jumper

Jasper JJ and Mc Namara James[11] in 1995 described a modification of Herbst bite jumping mechanism known as Jasper Jumper,[3,11-14] that can be attached to fixed appliances. This interarch flexible force module allows the patient greater freedom of mandibular movement than is possible with original bite jumping mechanism of Herbst.

Churro Jumper

The Churro Jumper, developed by Dr. Castanon *et al.*, (1998)[15] furnishes orthodontists with an effective and inexpensive alternative force system for the antero-posterior correction of Class II and Class III malocclusions. The appliance functions more like *Jasper Jumper.*[15,3,10]

Klapper super Spring

In 1998 Lewis Klapper[3,10] introduced the Klapper superspring for the correction of class II malocclusions. On first glance the device resembles a Jasper Jumper with the substitution.

Forsus Nitinol flat Spring

In 2003 William Vogt[16,17] introduced two new fixed intraarch spring devices for class II correction, the Forsus Nitinol Flat Spring and the Forsus Fatigue Resistant Device.

Forsus Fatigue Resistant Device

Device is an interarch push spring that produces about of force when fully compressed. Unlike other push spring appliance, FRD can intrude maxillary first molars and thus correct a malocclusion without opening the bite. The distal end of the FRD’s push road insert into the telescoping cylinder. And a hook of the mesial end is crimped directly to the arch near the canine or premolar brackets. The scoping cylinder consists of inner and outer slide tubes surrounded by an open coil spring. An eyelet at the distal end of the cylinder is connected the maxillary molar headgear tube with an L pin. The push rod has a built in stop that compress the spring when the patient’s mouth closes. The spring force is then transferred to the maxillary molars, using the mandibular arch as the anchorage unit.

Eureka Spring

In 1997 Devincenzo[18] described the Eureka Spring, which is a fixed inter maxillary force delivery system.[18,3] it’s a compression type of spring. And compression spring have inherent advantages over extension and curvilinear counterparts, including reduced spring fatigue, resulting in less breakage, increased extension, resulting in force application over a wide range of mouth positions. On full compression, all these springs exert 225 ± 25 gm / cm^2 of force, but Eureka spring force is 160 ± 20 gm / cm^2. Eureka spring in a complete Class II patient, nonextraction application with the mouth closed and opened to 60 mm. the internal spring transmits a distalizing force to the maxillary dentition and an equal and opposite mesializing force to the mandibular teeth. The mechanics of the appliance has the opposite effect to that of class II elastics in that it acts to intrude both the lower incisors and the upper molars. The effects of this appliance are entirely dento-alveolar and no orthopedic or bite-jumping effects are claimed by the clinicians who have developed the appliance. The dento-alveolar effects achievable with this appliance include maxillary molar distalization or advancement of lower anterior teeth in class II cases. A study (McSherry & Bradley, 2000)[10] carried on 37 consecutive Class II treatments was reported to produce an antero-posterior correction of 0.7 mm per month with equal amounts of maxillary and mandibular movement.

Twin Force

In 2004, Jeff Rothengerg *et al.,*[19] introduced a new fixed functional appliance for molar distalization in Class II cases. The TFBC is a fixed, push type intermaxillary functional appliance with ball and socket joint fasteners that allow a wide range of motion and lateral jaw movement. At full compression, the TFBC postures the patient's mandible forward into an edge to edge occlusion. At 60 mm mouth opening considerable extra extension still exists, this permits the use of a shorter model, which is also available and attaches to the mesial of maxillary first molar. This greatly increases the vertical component of the force vector and hence more intrusion is observed per millimeter of sagittal correction.

Removable Intraoral appliances

Cetlin Appliance

The appliance involves a combination of an extraoral force in the form of headgear and an intraoral force in the form of a removable appliance. The Cetlin appliance utilizes a removable appliance intraorally to tip the crowns distally and then an extraoral force to upright the roots.

ACCO Appliance

The ACCO[20] (Acrylic Cervical Occipital anchorage) appliance is a removable acrylic appliance which is used in conjunction with a Northwest Headgear to effect distal mass movement of buccal segments. The buccal segments involved are usually maxillary, but the appliance can be used as well on mandibular buccal segments. The appliance is originally devised by Dr. Herbert Margolis[20] to be used to “harness Growth”, i.e. the entire maxilla was to be restrained while mandible was to be allowed to express its growth potential.

Molar Distalization with Magnets

Magnets were introduced in orthodontics to generate simultaneous force fields and bioeffects that may account for observed benefits.[5,6,22-26] Kawata *et al.*, in 1987 used a tractional magnetic force, which produces a week orthodontic force that increases in magnitude s tooth movement occurs. Gienally *et al.,*[5] in 1988 and Takami Itoh[21] in 1991 had used a repelling type of magnetic force for distal tooth movement. In 1988 Anthony Gianally[5] used intra arch repelling magnets anchored to a modified Nance appliance cemented on the maxillary first premolars , were activated against the maxillary first molars to move them distally. Eighty percent of the space created represented distal movement of the first molar. Although, N. ERVERDI *et al.*, (1997)[22] had done a study to compare two intra oral molar distalization procedures, involving 15 cases with class II molar relationship. Magnetic device were applied to the upper right first molars in each case, while nickel-titanium coil springs were used against the upper left first molars, for a period of 3 months. Measurements were made form lateral Cephalograms and from photocopies of models taken before and after distalization procedure. Although distalization was achieved with ease in both techniques, nickel titanium coil springs were found to be the more effective in terms of movement achieved.

Japanese NITI Coils

Gienally *et al.*, (1991)[27] described the use of 100 gm super elastic coils developed by Miura et al. to move the maxillary molars distally in class II correction. Molars can be moved distally 1 to 1.5 mm/month with one 8 to 10 mm activation of the

100 gm coils that are used in conjunction with vertical slotted fixed appliance (0.020”).

According to Gianelly success rate and prognosis differ for different age group.

1. When first molars are moved distally in the late mixed dentition stage of development, the procedure is 90% successful. And molar correction can be completed within 4-8 months.
2. In the adolescents, when first molars are moved distally after the eruption of the second molars, they tends to move more slowly and anchorage loss increases. Cusp to cusp molar relationships is corrected reasonably well. Full class II relationship is much more difficult to resolve.
3. In the adult, the success rate is highly variable and more failures are noted.

Jones Jig

In 1992 Richard Jones and Michel White[28] introduced the appliance called Jones Jig; use an open coil nickel titanium spring to deliver 70-75 gm of force, over a compression range of 1-5 mm to the molars. The appliance is capable of producing maxillary molar distalization with second molars erupted or unerupted, in the mixed or permanent dentition, and in growing or non-growing individuals. For a more predictable appliance, Jones Jig is modified by Dr. Hickory to be usable without anterior braces. As usual a Nance is placed from the first premolars for anchorage. To avoid braces on the anterior teeth vacuform aligners are used with bonded buttons to support Class II elastics. You might consider adapting your most efficient molar distalizing appliance(s) to be suitable for pre-Invisalign® use.

Pendulum Appliance

This was introduced by *Dr. Hilger*[29,30] in 1992. It is a hybrid appliance that uses a large Nance acrylic button in the palate for anchorage, along with 0.032” TMA spring that deliver a light, continuous force to the upper 1st molars without affecting palatal button. Thus, the appliance produces a broad, swing are or pendulum of force from midline of the palate to the upper molars. The pendulum spring produces a light continuous force on the maxillary 1st molars. The spring can also be adjusted to expand and rotate the max 1st molars. Due to the nature of the pendulum springs which are of a constant length, the max. Molars have a tendency to go lingually when distalized. To compensate for this shortcoming it is prudent to open the horizontal adjustment loop utilizing a bird beak plier, which lengthens the pendulum springs and helps prevent the unwanted lingual movement. This horizontal adjustment loop adds some flexibility to the wire, which also facilities the insertion of the pendulum spring into the lingual sheaths. If expansion is needed mid palatal jackscrew can be incorporated into the center of nance portion – “PENDE-X” force produced is 200 to 250 Grams. Abu. A. Joseph and Chris Butchart, studied effects of the Pendulum Appliance on molar distalization on vertical dimension and anchorage loss measured at the incisor and molar teeth, and found out that distalization occurred quite rapidly with over correction beyond a Class-2 molar relationship completed in an average time of 3-4 months. Mean distal movement of upper first molar was 5.1 mm. This movement was accompanied by a mean change in angulations of 15.7^0. Anchorage loss was evident with a mean increase in incisor angulations of 4.9^0 and an average advancement at the incisal edge of 3.7 mm vertical dimension was unaffected.

Distal Jet

Developed by Dr.Carano and Dr.Testa[31] in 1996. It is a fixed lingual appliance that can produce unilateral or bilateral molar distalization typically in 4-9 months without relying on patient cooperation. The appliance permits simultaneous use of full bonded appliances, thus avoiding the need for two phase treatment. According to the author the rate of molar movement with distal jet appliance is comparable to that reported with magnets and NiTi coil springs but was achieved without tipping or rotation and with no loss of anchorage. Several clinically useful modification of the original appliance has been proposed. In 2001 Vonny *et al.,*[86] found Distal jet appliance distalized the maxillary molars, but there was significant loss of anchorage. The distal jet also showed less tipping of the maxillary molars and better bodily movement of molars because; the force was applied closer to the center of resistance. Patricia chiu *et al.,*[33] in 2005. Compared the dentoalveolar and skeletal effects on class II malocclusion of the distal jet with pendulum appliance and found During molar distalization, the pendulum showed more distal molar movement and significantly less anchorage loss than distal jet. The distal jet could be used simultaneously with fixed appliances and the pendulum were equal in their abilities to move the molars bodily.

Carriere Distalizer

Luis Carriere[34] in 2004 developed a new Class II distalizer with advanced computer technology. Brachyfacial patterns respond best to treatment; Dolichofacial types are less responsive. Growing patients are ideal, but adults can be treated as well. Mixed dentition Class II cases with fully erupted first molars are candidates for first-phase treatment.

CONCLUSION

Since the beginning of the century, molar position and the relationship between opposing molars have been a key topic of the orthodontic literature. Molar Distalization therapy today has already become an important weapon in the orthodontist's armamentarium. Of the various suggested modalities of Molar distalization, some have been investigated by clinical research, others remains hypothetical and await investigation. Though a number of appliance systems are available, every clinician should cautiously begin with a precise diagnosis, sound treatment plan and appliance selection taking into consideration various factors pertaining to the case selection like the age of the patient, growth pattern and also the factors relating to a particular appliance system (Molar Distalizers). Therefore any one molar distalizer cannot be concluded to be ideal for any clinical situations.

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