

## REVIEW ARTICLE

# Distal Driving Of Molars – A Review

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**ABSTRACT**

Distalization of maxillary molars with intraoral appliance is a non-extraction treatment approach for correction of Class II malocclusion that has been described as an alternative to headgear. The aim of this review article is to discuss about the various criteria that should be considered while deciding to distalize molars and a comprehensive review of commonly used intraoral molar distalization appliances.

**Keywords:** Non extraction treatment, Space gaining, Molars

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**INTRODUCTION**

To extract or not to extract has been a key question in planning orthodontic treatment for past 100 years. It has always been and still remains one of the longest running controversies in orthodontics. Whenever there is a space deficiency, the methods of gaining space that strikes our mind are extraction, expansion, distalization and stripping.<sup>1</sup> It is useful for the clinician to know the effects of different

treatment options and what they offer to the patient. Recent developments in mechanotherapy and changes in concepts have reduced the need for extraction in several types of discrepancies. Management of borderline cases has always surmounted controversies. An estimated 25-30% of all orthodontic patients can be benefited from maxillary expansion, and 95% of Class II cases can be improved by molar rotation, distalization and expansion.<sup>1</sup> In recent years, molar distalization has evolved as an alternative method of gaining space and correcting molar relationship in dental Class II malocclusions.

**HISTORICAL PERSPECTIVE:**

Kingsley was the first person to try to move the maxillary teeth backwards in 1892 by means of headgear. Oppenheim advocated that position of mandibular teeth as being the most correct for an individual and use of occipital anchorage for moving maxillary teeth distally into correct relationship without disturbing mandibular teeth. In 1944, he treated a case with extraoral anchorage for distalizing maxillary molar.

**CRITERIA FOR MOLAR DISTALIZATION:<sup>2</sup>**

Following factors must be considered while planning for distalization:

1. Straight or mildly convex
2. Horizontal growth pattern
3. Deep bite cases
4. Decreased Lower Anterior Facial Height
5. Favourable growth pattern: According to Lande, mandible outgrows maxilla in a normal favourable growth pattern which is advantageous for distalization.
6. Timing of treatment: The recommended time is the mixed or early permanent dentition. However with the use of implants, distalization can also be attempted in adult patients.

7. Second and Third molars: A controversy exists concerning the influence of 2nd/3rd molars on the distal movement of 1st molars.
8. Dentoalveolar malocclusion: End on or full cusp class II molar relationship due to:
  - a. Mesially migrated or tipped maxillary molar due to early loss of deciduous tooth.
  - b. Ectopic eruption of maxillary canines and premolars
  - c. Mild to moderate crowding in maxillary anteriors. Arch discrepancy of 3-5mm.
9. Long distal bases: According to Ricketts, to plan distalization, PTV6 must be at least "age of patient +3 mm.
10. Normal temporomandibular joint .

## CLASSIFICATION OF MOLAR DISTALIZATION

Appliance used to distalize molar can be divide in to two categories:

- A. Extra-oral : Headgear.
- B. Intra-oral
  - a. Interarch appliances: Herbst appliance, Mandibular Anterior Repositioning Appliance, Flex Developer, Eureka Spring.
  - b. Intraarch appliances: Pendulum appliance, Distal Jet, First class appliance. Orthodontic implants.

### Advantage of IOA over EOA

- a. Independent of patient compliance
- b. Provides continuous force
- c. Side effects like posterior cross bites due to the force delivery system can be avoided.

## VARIOUS INTRAARCH APPLIANCES

**3-D Bimetric Distalizing Arch** (1987 by Wilson and Wilson)<sup>3</sup>: The anterior portion is of 0.022" true chrome arch while posterior segment is of 0.040" end section with omega loops. Elgiloy open coil springs are placed between omega loop and buccal tubes for activation.

**Repelling Magnets:** (1988 by Gianelly et al.)<sup>4</sup>: Prefabricated with repelling samarium cobalt magnets. Forces measure to 200-225 gms but drop substantially as space opens beyond 1mm.

**Pendulum Appliance** (1992 by Hilgers)<sup>5</sup>: Consist of large acrylic Nance button and two 0.032" TMA springs that are active elements for molar distalization (Figure-1).

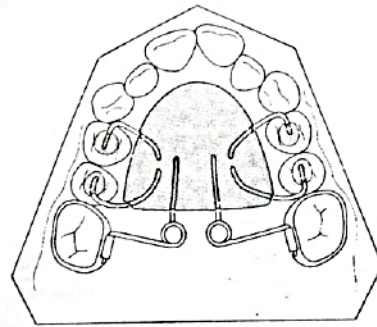


Figure-1: Pendulum Appliance

### Modification Of Pendulum Appliance:

**Pendex Appliance:** The design is similar to pendulum appliance except for the addition of a midpalatal jack screw into the centre of Nance button. Therefore it can be used when expansion is required or to avoid constriction during distalization.

**K Pendulum Appliance** (Kinzinger et al): Here nance button is divided in two sections by a distal screw. Anterior one provides anchorage. Posterior section accommodates pendulum springs .

**Penguin Pendulum Appliance:** It differs from the pendulum appliance as in this the springs are fabricated with the distalizing arms close to parallel to the molar root to prevent buccal or lingual movements while allowing rotation of tooth if required. The other difference is that the appliances is relatively thinner and so avoid creating any iatrogenic tongue thrust.

**Superelastic niti wire:** Locasystem (1992 by Locatelli et al)<sup>6</sup>: By placing crimpable stops mesial and distal to a compressed section of wire, it was possible to generate 100g of distal pressure against the maxillary molar. But there is more anchorage loss.

**Jones Jig** (1992 by Jones and White)<sup>7</sup>: It includes an active unit positioned buccally consisting of active arms or jig assemblies incorporating nickel titanium open coil springs and anchorage unit as modified Nance appliance. Advantages are better

control over molar distal tipping and rotation and continuous force application ((Figure-2).

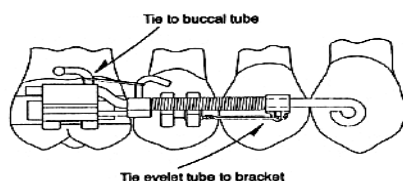


Figure-2: Jones Jig

#### **Modification of Jones Jig appliance:**

**Lokar Appliance** (1996 by Scott)<sup>8</sup>: Consist of NiTi coil spring activated by a mesial sliding sleeve and appropriately sized rectangular wire which is inserted into the arch wire tube of first molar. The advantages include production of persistent and predictable results, increased efficiency, easy insertion and short chair time for insertion as well as for checking progress.

**Modified Jig Sectional Assembly** (1998 by Papadopoulos)<sup>2</sup>: The active unit consists of active arm fabricated from a round 0.028" stainless steel wire with a length of 30- 35mm. A 3mm long open loop constructed at a distance of 8mm from wire ends divides the wire into distal and mesial sections. A NiTi open coil spring is inserted through the mesial end. The distal tube and mesial tube are inserted mesial and distal to the spring respectively.

**Distal Jet Appliance** (1996 by Carano and Testa)<sup>9</sup>: Constructed with two bilateral tubes embedded in a modified nance button. A NiTi open coil spring and activation collar are placed on each tube as active unit. The advantage of this appliance is that more of a bodily movement of molar is seen rather than distal tipping as it is placed closer to the centre of resistance of tooth.

**Nickel Titanium Double Loop System** (1998 by Giancotti and Cozza)<sup>10</sup>: For simultaneous distal movement of the maxillary first and second molars, using a superelastic nickel titanium wire with shape memory (NeoSentalloy).

**First Class Appliance** (1999 by Fortini and his co-workers)<sup>11</sup>: A particular feature of the appliance is that it produces rapid molar distalization with minimal tipping even

in the presence of second molars. The distal movement of molar takes place on a double track system that prevents any rotations and constrictions .

**Intraoral Bodily Molar Distalizer (IBMD)**<sup>12</sup> 2000 by Keles and Sayinsu. Here TMA springs were used for distalization.

**C Space Regainer** (2000 by Chung and co-workers)<sup>13</sup>: A removable appliance was introduced in order to overcome the drawback of anchorage loss by various intraoral methods of molar distalization.

**Keles Slider** (2001 by Keles)<sup>14</sup>: This appliance also produces bodily movement as the force is applied closer to centre of resistance (with the help of soldered tube on molar) like distal jet appliance (with the help of bayonet wire passing through lingual sheath on molar). Nance button with an anterior bite plane serves as anchorage unit.

**Frog Appliance** (2003 by Kevin C. Walde)<sup>15</sup>. The name comes from the fact that for a patient the Nance acrylic button that is part of the device looked like a frog. It is activated by simply turning the screw counter clockwise (Figure-3).



Figure-3: Frog Appliance

**Carriere Motion Appliance** ( 2004 by Carriere): It is a direct bond appliance that attaches to the maxillary canine and first permanent molar. Eliminates wire changes and the distorting collateral forces that appear with every wire activation used in traditional methods. Once the appliance is bonded, the Carriere Oral Elastics are attached from the mandibular molar to the hook of the maxillary cuspid of the Carriere Motion Appliance to activate.

#### **Distalization using miniscrew and palatal implants supported system.**

When intraoral appliances are inserted to distalize molar, despite the anchorage arrangement, anchorage loss still occurs. Since the loss of anchorage may lead to prolonged treatment time

and less predictable treatment results, use of implants have an important role to play.

**Bone anchored pendulum appliance, BAPA** (2006 by Beyza)<sup>17</sup>: A mean distalization of 6.4mm, and a class I molar relationship in 7 months without loss of any anchorage could be achieved.

**Miniscrew implant supported distalization system. MISDS** ( 2008 by Papadopoulos )<sup>18</sup>: In this design two miniscrews were used in the anchorage units . The treatment lasted for 4-6 months depending upon the severity.

**Skeletal Frog Appliance** (2011 by Ludwig and co-workers)<sup>19</sup>: Design is similar to Frog appliance with the addition of two miniscrews for skeletal anchorage and the biomechanical principles are similar to K pendulum .

**Topjet Appliance** (2013 by Winsauer et al)<sup>20</sup> : It was designed to avoid additional laboratory steps, allowing simple chairside placement at a single appointment. There is low incidence of undesirable tooth movement .

## CONCLUSION

Case selection for molar distalization is very important and various factors have to be taken into consideration before deciding the treatment plan. Noncompliance intramaxillary molar distalization appliances used for the correction of Class II molar relationships all act by distalizing molars with a concomitant and unavoidable loss of anchorage. This limitation can be overcome by alternate anchorage designs using miniscrews and implants.

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