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Review Article

Role of Molar Distalization in Orthodontics: A review of the literature

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ABSTRACT:
Nonextraction treatment of Angle Class II malocclusion usually requires distalization of maxillary molars. The major drawbacks regarding extraoral appliance is totally rely on patient cooperation. More recently, researchers have tried to defeat this major problem by introducing new intraoral systems involving rigid skeletal anchorage. The intraoral molar distalization process has been an excellent choice for patients who are reluctant to wear a headgear. This review article elaborates about the role of molar distalization in orthodontics.
Key terms: Molar distalization, class II malocclusion, Intraoral.

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INTRODUCTION

The maxillary molar distalization technique used in orthodontics for past few decades. Class II malocclusions are most common problem frequently encountered in orthodontic practice. Generally, Orthodontist aims for the bodily tooth movement and one of the example is molar distalization.[1] Various types of tooth movements are Tipping (Controlled and Uncontrolled), Bodily tooth movement, torquing, & rotations. The easiest type of tooth movement is uncontrolled tipping which frequently occurs in the initial wires during fixed mechanotherapy and toughest one torquing. So in order to prevent torque loss, the bodily tooth movement is tried to be achieved. Bodily tooth movement is said to be achieved, if the whole tooth moves to the same distance maintaining the same inclination and angulation as that was present before the tooth movement. Thus, if pre treatment and post treatment angulation of the tooth is same, it suggests that no tipping has occurred, and the tooth has moved bodily.[2] The distalization of the maxillary first permanent molar teeth may be considered as treatment option for patients presenting with an Angle's Class II malocclusion characterized with an increased overjet and anterior crowding. This method is indicated in the space gaining in the upper arch and to correct distal tooth malposition, it is used in class II malocclusion with mild maxillary dentoalveolar protrusion and crowding, in end on molar relationship, in tipped upper molars, class II subdivision cases requiring unilateral distal molar movements, space gaining. Molar distalization can be performed with the use of intraoral or extraoral appliances. There are much controversy exist in treating class II malocclusion in orthodontics. Potential issues arising with patient compliance may be associated with the prolonged use of headgear, rubber bands and elastics since 1980. Due to lack of patient cooperation, clinician must often change treatment approach. To optimize the treatment approaches, many appliances have been introduced. There has been an increasing trend in the clinical use of intraoral appliances that require minimal need for patient cooperation. However, most

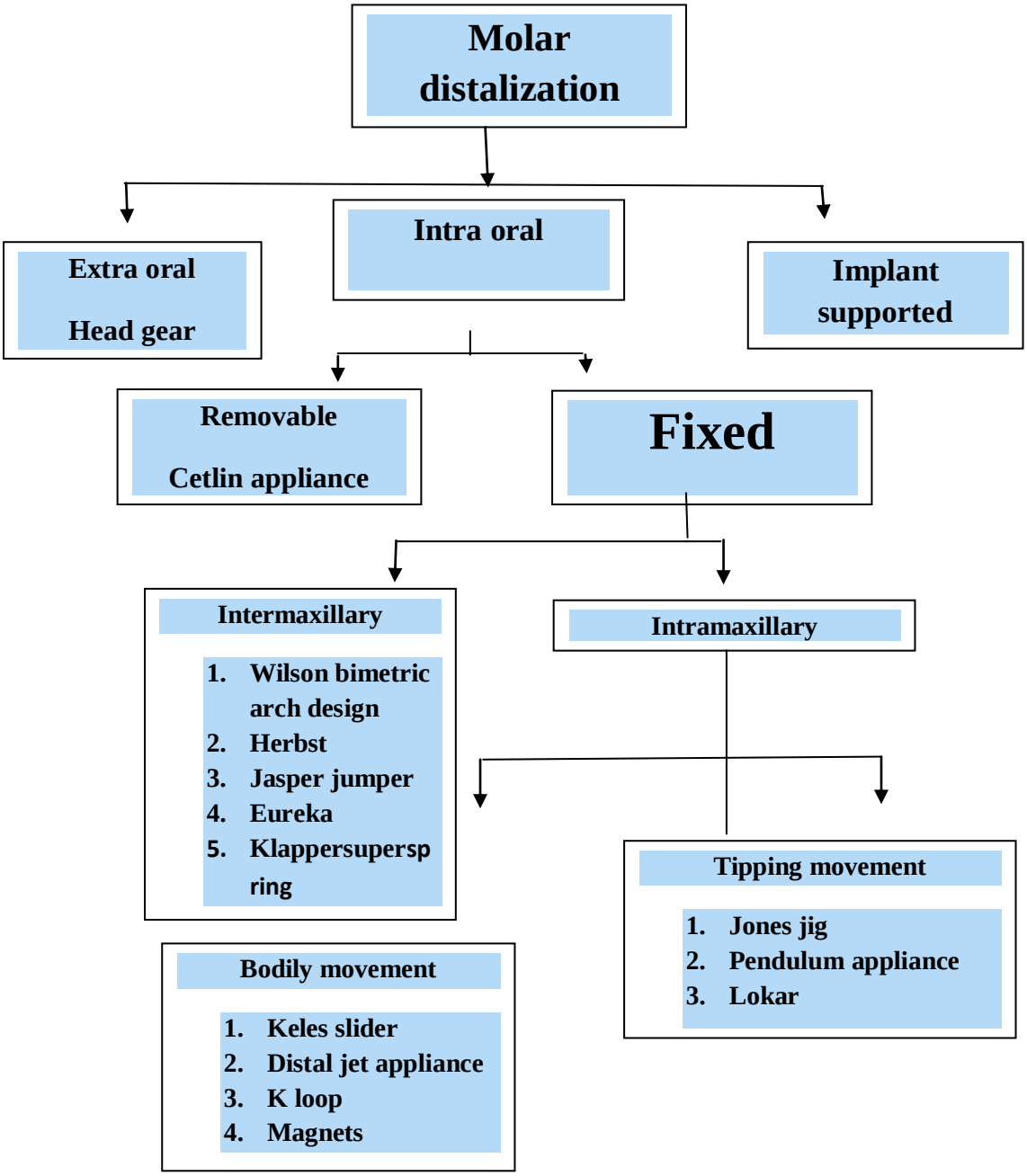
tooth-borne appliances for upper molar distalization produces an unwanted side-effect of anchorage loss resulting in maxillary incisor proclination, overjet increase, tipping of molars during distalization, extrusion of molars.

To minimize anchorage loss, mini-implants have been incorporated into the design of maxillary distalization appliances.[3] Mini-implants can be positioned intraorally with minimal degrees of surgical invasiveness, are readily integrated with concomitant biomechanical initiatives, and are relatively cost-effective.[4,5,6] This article discusses about types of each appliances and efficiency of distalization in orthodontics.

DIAGNOSTIC CRITERIA FOR DISTALIZING MAXILLARY MOLAR

1.Class II molar relationship
2.Maxillary molar protrusion
3.Mild or moderate crowding
4.Good maxillary second molar position
5.Class I skeletal pattern
6.Straight profile
7.Good soft tissue drape
8.Patient cooperation

METHODS OF MOLAR DISTALIZATION



DISTALIZATION USING HEAD GEAR:
Distalization of molars using head gear is a very efficient method as the reciprocal forces are not transmitted to the other teeth. The movement of molars depends on the direction and magnitude of force.

HIGH PULL HEADGEAR OR OCCIPITAL PULL HEAD GEAR

- They derive anchorage from back of the head.
- They cause a posterior and intrusive effect on the maxillary dentition.
- Force is more vertically directed so used in individual with increased vertical height.
- Indicated in class II patients with tendency of open bite.

LOW PULL OR CERVICAL PULL HEAD GEAR[8]

- Derives its anchorage from the nape of the neck.
- Produces inferior and distal force to the maxillary dentition.
- They are used in correction of class II division 1 malocclusion with deep bite.
- Its effect is in correction of the maxillomandibular relationship by restriction of maxillary anterior displacement; distalization and extrusion of maxillary molars; and slight maxillary expansion.

MINI IMPLANT SUPPORTED
Mini-screw fixation there is a way to prevent or eliminate anterior anchorage loss during molar distalization, as it provides absolute anchorage. The Mini-screw can be placed either buccaly or palatally to distalize the first molars.

- The Mini-screw in combination with Distal jet appliance may provide a less invasive alternative to the anchorage loss. In this case the Mini-screw is placed in the Maxillary alveolar process, between the palatal roots of the first and second pre-molar. This mechanical system prevents mesial movement of the anterior teeth during molar distalization.
- Alternatively the Mini-screw can be placed buccaly between the second pre-molar and first molar and the distalization is achieved by activation of the Nitinol springs, placed on a sectional arch wire between first premolar and first molar. The first pre-molars are stabilized indirectly with mini-screw and a palatal arch placed on first pre-molars to prevent anchorage loss.

Different types of molar distalization methods according to amount of molar movement

- < 3 mm o Using inter-radicular space
- > 3 mm o Using Non-alveolar bone area i.e indirect anchorage combined with pendulum appliance or Distal Jet Appliance combined with inter-maxillary elastics[9].

INTRA ORAL REMOVABLE APPLIANCE
CETLIN APPLIANCE

- It was introduced by N.M.Cetlin and Ten hove in 1983.This appliance involves the use of extra oral force in form of head gear and intra oral force in form of removable appliance.
- The intra oral removable appliance causes the distal tipping of the crown and the extra oral head gear uprights the roots of the molars.
- Gentle force of approximately 30 gms is used with minimal reaction on upper anterior teeth and worn 24hrs/day.
- The anchorage for the removable appliance is from the proper adaptation to the palate and the acrylic shield round the four maxillary incisors and modified adam's clasps on the premolars[10].

FIXED:

INTERMAXILLARY:
WILSON BIMETRIC ARCH DESIGN

- This appliance was used for the functional class II correction.
- Maxillary molar and buccal segments are distalized bilaterally or unilaterally without headgear. It consist of labial arch made up of 0.040 posterior section and 0.020 anterior section. Hooks for class II elastics are soldered on to the anterior end of the 0.040" section, and adjustable omega loop is placed in the premolar region of the 0.0040 section. The appliance is activated by placement of an open coil spring between the omega loop and the maxillary first molar.
- They use a 3D Bimetric distalizing Arch and3D mandibular Lingual Arch with Class II elastics.
- Elgiloy open coil spring is placed between omega loop and buccal tubes for activation.
- Distal tipping of the molars premolars and canine were seen.[11,12]

HERBST APPLIANCE

- The Herbst Appliance as originally designed by Emil Herbst in 1905 and was reintroduced by Pancharz, Herbst appliance is a passive tube and plunger system with the exact length of the tube determining the amount of anterior mandibular displacement.
- It approximately deliver both skeletal and dental effects.

- They have pronounced high pull head gear effect on the molars.
- They favour the correction of class II molar relationship.
- There is mesial movement of the mandibular incisors, this effect is favourable in cases were the mandibular incisors are retroclined.
- The appliance has bands on upper 6's and lower 6's and 4's. palatal bar and lingual bar
- Telescopic arm from upper 6's to lower 4's.[13,14]

JASPER JUMPER

- Introduced by Jasper J.J and Mc Namara James in 1995
- Inter arch flexible-force module allows the patient greater freedom of mandibular movement than possible with herbst appliance.
- It has two parts force module and anchor units.
- Their effects were restrictive effect on the maxilla, a slight increase in anterior face height, retrusion and extrusion of the maxillary incisors, labial tipping and protrusion of the mandibular incisors.
- The modules are available in seven lengths, ranging from 26mm to 38 mm in 2mm increments.
- Intrusion and distalization of the maxillary molars and extrusion and mesialization of the mandibular molars were seen.[15,16]

EUREKA SPRING

- In 1997 Devincenzo described the Eureka spring differs in length for extraction and non extraction cases.
- It is a telescopic appliance fitted to the upper molar bands and distal to the lower canines. It has an open coil placed inside the system.
- The internal spring transmits a distalizing force to the maxillary dentition.
- The dento-alveolar effects achievable with this appliance include maxillary molar distalization or advancement of lower anterior teeth in class II cases.[17]

KLAPPER SUPER SPRING

- In 1998 Lewis Klapper introduced and it is flexible spring is attached between maxillary molars and mandibular canines. They lie in the vestibule when activated.
- The open helical loop of the spring is twisted like a J hook onto the mandibular arch wire.
- It is an compression type of spring
- On maxillary end it is attached to the standard headgear tube as in super spring I or to a special oval tube and secured with a stainless steel ligature wire as in super spring II.
- The appliance comes in two sizes ,27mm primarily designed for extraction cases and 40 mm for non extraction cases
- It creates a moment on the molar which is expressed as the distal root tip and molar extrusion.[18]

INTRAMAXILLARY

KELES SLIDER

- The Keles Slider has two premolar and two molar bands, and the anchorage unit is composed of a wide Nance button. This appliance does not incorporate headgear or elastics, and it is not removable.
- There is distalization of the class II molars. There was minimal anchorage loss on the premolars and little incisors proclination.
- The premolars drifted distally with the help of transseptal fibres.[19,20]

DISTAL JET APPLIANCE

- The appliance design consists of bilateral piston and tube arrangement, tube embedded in an acrylic Nance button, supported by attachments on the first premolars; a bayonet wire inserted into the lingual sheath of each first molar band, the free end inserted into the tubes; a clamp-spring assembly around the tube.
- Regular reactivation of the loaded coils resulted in consistent distalizing forces and uprighting moments, in forces and moments toward buccal as well as slightly intrusive forces, and mesial-inwardly rotating moments. In the sagittal dimension, the Distal Jet appliance allows almost translatory molar distalization.
- Since the application of force is palatal to the center of resistance of the molars, the teeth experience undesired mesial-palatal and distal-facial rotation.[21-23]

Modifications of Distal Jet

- Double set screw distal jet
- Conversion to Nance holding arch:
- Distal jet Hex Key Handle
- Modified mandibular distal jet

K-LOOP

- The appliance was designed by Dr. Varun kalra. The appliance consists of a K-loop to provide theforces and moments and a Nance button to resist anchorage. It is made up of 0.017 x 0.025" TMA wire.
- The legs of the K are bent at 20 degree and inserted into the molar tube and the premolar

bracket. Each loop of the K should be 8mm long and 1.5mm wide.
- The 20° bends in the appliance legs producemoments that counteract the tipping moments created by theforce of the appliance, and these moments are reinforced bythe moment of activation as the loop is squeezed into place.[24,25,26]

JONES JIG APPLIANCE
- In 1992 Richard jones and Michel white introduced jones jig appliance.
- Jones Jig, uses an open-coil nickel titanium spring to deliver70-75g of force, over a compression range of 1-5mm, to themolars.
- It utilizes a modified nance palatal button. It produces low and continuous force.
- It is placed on the buccal aspect of the maxillary molars.
- The maxillary first molar is moved distally and there is extrusion, there is mesial movement of the premolars.[27,28,29]
- Anchorage is obtained from palatal nance button.

PENDULUM APPLIANCE
- Introduced by Dr.Hilgers in 1992.
- Pendulum appliance moved the molars distally without creating dental or skeletal bite opening and with little incisor anchorage loss.
- They consists of an anteroposterior acrylic Nance portion with an expansion screw and two posteriorly extending TMA coil springs and fitted into the lingual sheath.
- The appliance is bonded to the maxillary premolars or molars avoiding occlusal interferences.
- Pendulum appliance is activated at 45 degree and .The appliance is activated by using a bird beak plier.
- During activation care should be taken to prevent opening or widening of the coil.
- Activation is based on the movement required.
- It causes expansion along with distalization.[30-32]

LOKAR APPLIANCE
- Lokar distalizer was introduced by Scott (1992).
- The prefabricated assembly consists of mesial slidingcomponent inserted intoarchwire tube of molars.
- Lokar appliance is best used in conjunction with nance buttonconstructed on second premolars.
- Molar tubes are not used, therefore extra oral and lip bumper forces may be applied concurrently.
- The Lokardistalizer is activated by compressing spring 1 to 2 mm short of complete compression and movement is 1-3 mm in 5-6 weeks
- This appliance is offset to the buccal and rests along the buccal surface of premolars.[33]

Lip Bumper
- The lip bumper is a fixed functional orthodontic appliance. It works by altering the equilibrium between the cheeks, lips and tongue and by transmitting force from periodontal muscles to the molars where it is applied.Used for various purposes like molar anchorage, therapy of habits and Space gaining in the lower arch.

Acrylic Cervical Occipital Appliance (ACCO)
- It was Developed by Dr. Margolis. This removable appliance exerts a continuous distalizing force on the molars , with the springs reactive forces dissipated through the acrylic button in to the palate and the maxillary teeth mesial to the molars. It consists of a labial bow over the incisor , embedded in an acrylic wrap around plate with Adams clasps on the first premolars.
- .For optimal results the ACCO must be worn full time except during meals, and the headgear for 12-14 hrs/day.

C-Space Regainer
- Introduced by Kyu-Rhim Chung, Young-guk park and Su-jin in 2000. It is removable appliance used to achieve bodily movement without significant incisor flaring.
- It consist of labial framework 0.036 stainless steel wire and acrylic splint
- Closed helix is bent into the framework in each canine region.
- If maxillary expansion needed, expansion screw can be incorporated.

INDICATION
- Class II malocclusion with mild maxillary dentoalveolar protrusion/crowding or mild arch length discrepancy of 4-5mm.
- End on molar relationship with mild to moderate space requirement, mesially and lingually tipped upper molars.
- In a growing child to relieve mild crowding in normal or hypodivergent growth pattern
- Class II subdivision cases requiring unilateral distal molar movement

- Regaining the space loss due to mesial drift of first molars following premature loss of deciduous teeth.

CONTRAINDICATION

- Class I or III molar relation
- Dental open bite
- Distally inclined maxillary first molar
- Severe overjet and bimaxillary protrusion cases
- Severe class III pattern , Skeletal open bite
- Excess lower anterior facial height
- Convex profile
- Posteriorly and superiorly displaced condyles.

CONCLUSION

Among the various optional method of Molar distalization, few have been investigated by research, others remains imaginary and still other wait for investigation. In this situation where improvement are being made each and day by day, so expect that this lacuna will be filled in near future. Recent advance like Niti, Magnets and implant supported distalizing appliance will no doubt develop the procedure of the molar Distalization .

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