Maxillary molar distalization with the dual-force distalizer supported by mini-implants: A clinical study

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Introduction: The objective of this prospective study was to describe the clinical effects of a bone-supported molar distalizing appliance, the dual-force distalizer. **Methods:** The study group included 16 patients (mean age, 14.3 years) with Class II molar relationships. Study models and lateral cephalograms were taken before and after the distalizing movement to record significant dental and skeletal changes (Wilcoxon test). **Results:** The average distalization time was 5 months, with a movement rate of 1.2 mm per month; the distalization amounts were 5.9 ± 1.72 mm at the crown level and 4.4 ± 1.41 mm at the furcation level. The average molar inclination was 5.6° ± 3.7°; this was less than the amount of inclination generated by bone-supported appliances that use single distalizing forces. The correlation between inclination and distalization was not significant, indicating predominantly bodily movement. The teeth anterior to the first molar moved distally also; the second premolars distalized an average of 4.26 mm, and the incisors retruded by 0.53 mm. **Conclusions:** The dual-force distalizer is a valid alternative distalizing appliance that generates controlled molar distalization with a good rate of movement and no loss of anchorage. (Am J Orthod Dentofacial Orthop 2009;135:282.e1-282.e5)

A number of intraoral appliances have been developed,[1-4] such as nickel-titanium springs,[5,6] magnets,[5,7] distal jet,[8,9] first class,[10] Jones jig,[11,12] and pendulum,[13,14] among others, to distalize the maxillary molars in Class II patients without the patient's cooperation. A fundamental characteristic of these appliances is that they are tooth supported; this implies that the distalization force applied to the molars produces a reaction force on the anterior teeth with subsequent mesialization of these teeth and anchorage loss.[8-14] Additional loss of anchorage occurs during active retraction of the premolars and anterior teeth after molar distalization, even when distalization was accompanied by marked distal inclination of the molars.[10,14,15-18] A main goal of molar distalizing therapy is to obtain bodily tooth movement of the molars with minimal rotation and distal inclination.[10-18]

Molar distalizing appliances have been combined with various implants to achieve osseous anchorage and overcome the limitations of tooth-supported appliances. At the beginning, the appliances were anchored over osseous integrated implants[19,20]; this required complex surgical procedures and a period of healing to allow osseous integration of the implant before a force could be applied. Temporary mini-implants in orthodontics introduced several benefits: the possibility of immediate loading, lower cost, and more anatomic sites for implant placement.[21-23] Research has attempted to improve the practical characteristics of mini-implants in conjunction with distalizing appliances.[24-29]

Our objective in this study was to investigate the clinical effects of a new bone-supported molar distalizing appliance, the dual-force distalizer (DFD), with mini-implants for immediate loading, and application of distalizing forces to both buccal and palatal surfaces of the first molars to obtain bodily tooth movement.

MATERIAL AND METHODS

The sample for this prospective study consisted of 16 patients (12 boys, 4 girls) with an average age of 14.3 years at the beginning of treatment, with maturation stage 3 of the cervical vertebral maturation method (corresponding to the skeletal maturation spurt).[30] The

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The authors do not have a financial interest in the dual-force distalizer.
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inclusion criteria for the study were Class II dental malocclusion requiring distalization of the maxillary molars with various degrees of anterior crowding in the maxillary arch, normal or low-angle vertical relationships, and no dental caries, periodontal disease, or uncontrolled systemic diseases. The second molars were not erupted or had just recently erupted in all patients. They were informed about the procedures and signed informed consent form with their parents' approval. The research design was reviewed and approved by the Ethical Committee of CES University, Medellín, Colombia.

The appliance used in this study was the DFD (Fig 1), made of an acrylic button from which two 0.028-in wire arms spread out bilaterally, 1 toward the buccal zone from the mesial aspect of the premolars, and the other toward the palatal zone. Both arms were placed into 0.045-in tubes (vestibular and palatal) soldered to bands cemented to the maxillary first molars. Each arm had 2 stops. One was located mesially to the tube, and its function was to support an open nickel-titanium compressed coil spring. This spring acted as a piston exerting a distalizing force (250-300 g) to the molar during appliance placement. The other stop was located distally to the molar tube to set the end of the movement. The tolerance between the wire and tube diameters allowed for initial correction of molar rotation to reduce friction during tooth movement. The miniscrews were a type used in maxillofacial surgery for osteosynthesis; they are nonspecific miniscrews (Mondeal Medical Systems, Tuttlingen, Germany). An acrylic button was anchored to the anterior part of the palate with 2 miniimplants 11 mm in length and 2 mm in diameter.

An impression with the bands adapted to the maxillary first molars was taken. Then the bands were transferred to the impression, which was poured with plaster to manufacture the appliance. With the appliance ready, the operator (C.V., the same for all patients) made 2 perforations in the Nance button, 1 behind the other, in the anterior region of the palate. Then the appliance was cemented to the first molars, and the acrylic button was held on the palate to make pilot perforations through the previously made holes for placement of the miniimplants and the final setting of the DFD to the palate.

Nonsteroid analgesics were prescribed to the patients for 1 day, and instructions for appropriate oral hygiene were given. The patients were taught to maintain good oral hygiene and asked to use mouthwash regularly during orthodontic therapy. At every appointment, the soft tissues around the DFD were checked and cleaned if necessary.

The patients were evaluated every month, and, if necessary, the nickel-titanium coil springs were reactivated by placing a crimpable stop in the arms mesially to the coil spring. Distalization continued until the Class II molar relationship was overcorrected to a super Class I molar relationship. Then the vestibular arms were removed, and the appliance was left in place until the premolars and that canines moved to a Class I occlusal relationship, also by means of fixed appliances (for an average period of 6 to 8 months).

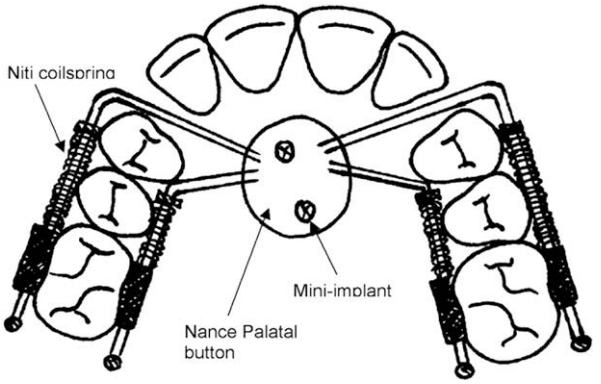

Fig 1. The DFD appliance.

Study models and lateral cephalograms were taken once the DFD was in place (T1) and again at the end of distalization (T2) to determine the vertical, sagittal, and angular changes of the first molars, the second premolars, and the maxillary incisors; the changes of the mandibular plane angle; and the positional change of the appliance by using cephalometric landmarks taken from previous studies (Fig 2).[29]

The interobserver and intraobserver calibration was made with an intraclass correlation coefficient of 0.984, indicating a high level of concordance. The rotation of the first molars and the intermolar distance were analyzed on the models with the AutoCAD program (Autodesk, San Rafael, Calif) with an intraclass correlation coefficient of 0.999.

Statistical analysis

A descriptive statistical analysis was performed by using central tendency measurements, dispersion measurements, and variation coefficients. A nonparametric test was used for paired data (Wilcoxon test) ($P < 0.05$) to compare inclinations, mesiodistal displacements, and vertical changes in the incisors, premolars, and molars during treatment (T2 vs T1).

The Spearman correlation coefficient was used to determine whether there was any correlation at the end of treatment between the inclination and the displacement of the molars, and between the distalization of the molar at the crown level and the furcation level.