

CHAPTER 23

An effective and precise method for rapid molar derotation: Keles TPA

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Introduction

A distal molar relationship could arise due to the mesiopalatal rotation of the maxillary molars. In some patients, an ideal Class I intercuspation can be achieved with the opposing molar and a Class II relationship can be corrected by molar derotation. The maxillary molars consist of three roots and due to the early loss of the deciduous second molars, the palatal root acts as a hinge for mesial rotation of the molars. Lemons & Holmes reported that a gain of 1–2 mm of arch length per side may be achieved following derotations.¹

The transpalatal arch (TPA) for molar derotation was introduced to the orthodontic literature by Goshgarian.² Cetlin & Ten Hove showed that the TPA is an effective device to stabilize, rotate, and distalize the molars.³ According to Ricketts, a line drawn from the distobuccal and mesiopalatal cusp tips of the first molars should pass through the cusp tip of the canines on the opposite side.⁴ Investigators have assessed the shape of maxillary first molars and examined the arch length gain with derotation.^{5–7} According to Braun et al, 2.1 mm arch length can be gained with the application of the TPA and an equivalent distal force at the level of the maxillary first molar center of resistance.⁸

The TPA can be removable or fixed, depending on the clinician's preference.

In 2003, we presented an effective method for rapid molar derotation by means of the Keles TPA.⁹ Our aim in this study was to develop an easy method to rapidly and precisely rotate the maxillary molars.

TPA Construction

The maxillary first molars were banded with a Precision lingual hinge cap attachment (Ormco, Orange, CA), welded on their palatal aspect (Fig. 23.1). The hinge cap attachment is designed to accommodate 0.032 × 0.032'' wires. The TPA was constructed from the Burstone lingual arch system (Fig. 23.2), which was introduced to the orthodontic literature in 1988.^{10–12} The wire consists of 0.032 × 0.032'' beta-titanium alloy (TMA, Ormco, Orange, CA). After the passive construction of the TPA, molar bands were cemented to the first molars (Figs 23.3 and 23.4) and the TPA was removed for activation (Fig. 23.5).

The method for activation is simple and precise. The TPA is placed on a piece of white paper and two lines are drawn along the terminal ends (rotating component) of the TPA with a black pen (Fig. 23.6). Additional lines are drawn with a 20° angle passing



Figure 23.1 Maxillary first molars were banded with precision lingual hinge cap attachment welded on their palatal sides. (From Keles & Imbram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.2 A transpalatal arch was constructed using the Burststone lingual arch system. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.4 Palatal view of the TPA design. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.3 After the passive construction of the TPA, molar bands were cemented to the first molars with the TPA. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.5 The TPA was removed for activation. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

through the distal end of the helix of the wire. The TPA is activated on both sides with the help of a bird-beak plier (Fig. 23.7). The biomechanics of the force moment system is presented in Figure 23.8. Two equal and opposite moments are generated on both molars. Two equal and opposite forces are generated on both sides which would also help to increase the intermolar width between the mesial cusp tips of the first molars. The activation of the TPA is checked on both sides and then it is placed in the mouth (Figs 23.9 and 23.10).

Unilateral activation of a TPA, as described by Cetlin & Ten Hoeve,³ would generate distal force on one side and rotation on the other side. After the correction of rotation of the molar on one side, Cetlin & Ten Hoeve recommend subsequent activation to rotate the molar on the other side a few months later. This would extend the treatment duration and generate unwanted distal forces. McNamara & Brudon have also indicated that the subsequent activation would generate a distal force on one side and rotation on the other side.¹³



Figure 23.6 Passive stage. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

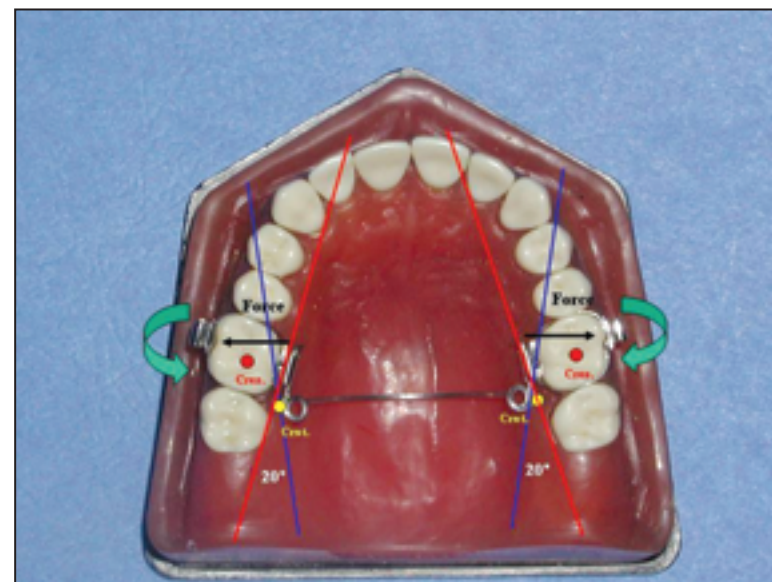


Figure 23.8 Biomechanics of the force moment system. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.7 Active stage. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figures 23.9, 23.10 The activation of the TPA is being checked on both sides. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

Case Study

DK was a female patient, 11 years and 3 months of age, diagnosed with edge-to-edge molar relationship. She was in the mixed dentition period and had crowding of 5.6 mm in the maxilla and 4.2 mm in the mandible. There was not adequate space for the eruption of the canines in the maxillary arch. Her maxillary first molars were severely

rotated mesiopalatally. She had an 80% anterior deep bite. Her pretreatment intraoral pictures are presented in Figures 23.11–23.14.

The treatment goals were to derotate the maxillary molars, correct the deep bite, align the maxillary and mandibular arches, and achieve Class I molar and canine relationship.

The treatment was started with the engagement of the TPA and derotation of the maxillary first molars (Fig. 23.15). Twenty-degree anti-rotation bends were constructed on the TPA and 2 months later



Figures 23.10



Figure 23.11 Patient 1, DK. Pretreatment anterior intraoral photograph. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

the rotations were corrected (Figs 23.16–23.18). After the placement of fixed appliances, the maxillary and mandibular arches were aligned and the deep bite was eliminated. At the end of orthodontic treatment, a Class I molar and canine relationship was achieved (Figs 23.19–23.22).

Discussion

The results showed that maxillary molars can be derotated effectively in 2–3 months. From a biomechanic point of view, the method described above has several advantages. With most techniques, due



Figure 23.12 Patient 1, DK. Right intraoral photograph. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.13 Patient 1, DK. Left intraoral photograph. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.14 Patient 1, DK. Upper occlusal intraoral photograph. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.15 The TPA was engaged and derotation of the first molars initiated. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.17 Patient 1, DK. Left intraoral photograph after the molar rotation. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.16 Patient 1, DK. Right intraoral photograph after the molar rotation. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.18 Patient 1, DK. Upper occlusal intraoral photograph after the molar rotation. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

to the mesiopalatal rotation of molars, the molar width between the mesial cusp tips is decreased. The method described here increased the intermolar width between the mesial cusps tips of the molars and maintained the intermolar width on the distal (see Fig. 23.18). In fact, the subsequent use of the conventional TPA, which was described in the literature, would tend to decrease the intermolar width on the distal rather than increase intermolar width on the mesial.

With this approach, palatal hinge cup attachments were used instead of TPA sheaths. The hinge cup attachment opens and shuts easily, which makes the clinical application practical and dramatically enhances TPA mechanics. In addition, this technique minimizes the

difficulty of lingual wire insertion and removal. A secure lock over the wire eliminates the double-back bend and ligature ligation that is required in many applications of traditional TPAs. The hinge cup attachment has 12° built-in torque in its base, which makes it an equally appropriate choice for both passive and active TPA application. Some investigators prefer the soldered rather than removable TPA.¹³ For bilateral molar rotation correction, however, subsequent activation and repeated cementation are required in order to obtain the desired bilateral rotational result.

Square-sectioned beta-titanium alloy wire enables three-dimensional control of the molar movement. In contrast, the traditional TPA uses a round stainless steel wire. The other advantage of beta-titanium



Figure 23.19 Patient 1, DK. Anterior intraoral photograph at the end of orthodontic treatment. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.21 Patient 1, DK. Left intraoral photograph at the end of orthodontic treatment. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.20 Patient 1, DK. Right intraoral photograph at the end of orthodontic treatment. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)



Figure 23.22 Patient 1, DK. Upper occlusal intraoral photograph at the end of orthodontic treatment. (From Keles & Impram,⁹ with kind permission of Quintessence Publishing Co. Inc.)

alloy wire is that it allows constant and long-lasting light force, without any plastic deformation.

In addition to rotating the molars effectively, after rapid palatal expansion this TPA can also be used to maintain and stabilize intermolar width and also to correct buccal crown tipping of molars by bilateral activation of the square-sectioned beta-titanium alloy wire for buccal root movement.

Conclusion

With the Keles TPA, bilateral molar derotation can be achieved in a short period of time. From a biomechanic point of view, this method eliminated the subsequent activation process and also increased the reduced intermolar width between the mesial cusp tips of the molars.

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