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Alignment of Impacted Canines with Cantilevers and Box Loops

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The availability of new materials has stimulated the development of various appliance designs for alignment of impacted canines. Superelastic wires, elastic threads, and chain elastics have made preadjusted edgewise techniques more efficient, while TMA wire has facilitated segmented techniques.1,2

This article will demonstrate the use of TMA cantilevers to extrude impacted canines, as described by Lindauer and Isaacson,3 and the use of TMA box loops to produce 1st- and 2nd-order corrections while continuing vertical eruption.

Orthodontic Procedure

Assuming adequate space has been created and maintained for the canine in the dental arch, the orthodontic procedure following canine exposure can be broken down into the following steps:

1. Initial extrusion mechanics with a cantilever.

2. Use of a box loop to continue canine extrusion and to make 1st- and 2nd-order corrections.

3. Incorporation of the canine into a continuous archwire for finishing.

Extrusion Mechanics with a Cantilever

In the system of segmented mechanics introduced by Burstone,1 the teeth to be moved are referred to as active units, and the teeth that provide anchorage are called passive units. Therefore, when aligning an impacted canine, the canine is the active unit and some or all the remaining teeth form the passive unit. Acantilever constructed from .017" × .025" TMA wire is inserted into the auxiliary tube of the first molar and connected by a one-point contact to the active unit (Fig. 1A). The magnitude of the force (F) used to extrude the canine should not exceed 70g.4 The moment (M) exerted by the cantilever against the passive unit (the posterior segments) is determined by F × D, where D is the distance between the point of force application (at the canine) and the point of attachment (at the molar).

The line of action of the force exerted by the cantilever on the canine can be adjusted according to the situation. For a buccally impacted canine, the choice would be either to extrude and mesialize the canine (Fig. 1) or to extrude and distalize it. A palatal push-force component or a buccal pull-force component can be added if necessary.

The cantilever thus produces a statically determinate force system on the canine, with the appropriate magnitude and direction of force application. The moment and forces applied against the passive unit can be resisted by stiff posterior archwire segments (.019" × .026" stainless steel) and by a transpalatal arch (.036" stainless steel).

Box Loop Mechanics

A box loop produces a statically indeterminate force system.5 When used for canine alignment, it is constructed of .017" × .025" TMA. The activation of the box loop depends on the desired position of the canine in both the sagittal and horizontal planes of space (Figs. 2A,B, 2C, 2D, 2E).

Discussion

In comparison to the segmented technique, the preadjusted edgewise arch has many disadvantages. Power chains and elastic threads show a rapid decay of force and provide relatively poor three-dimensional control, requiring frequent adjustments. Furthermore, they must be ligated to extremely stiff archwires to avoid deflection and possible side effects on adjacent teeth.6

A superelastic wire placed directly into the bracket of an impacted canine can produce significant side effects, including mesial tipping of the premolars and distal tipping and intrusion of the lateral incisors, which in turn can create a lateral open bite and undesirable rotation of the impacted canine. Vertical elastics are often used to counteract these side effects, but they require patient compliance and careful monitoring of the occlusal plane.

An overlay technique avoids unwanted side effects by using two archwires: a stiff, continuous stainless steel wire for anchorage and a flexible sectional wire (such as .014" or .016" nickel titanium) to align the canine.7 However, this procedure requires a delay before the entire arch can be leveled with a stiff rectangular archwire.

Because segmented cantilever mechanics create a statically determinate force system, they offer a predictable method of tooth movement. Box loops produce a statically indeterminate force system, but they are nevertheless effective in providing 1st- and 2nd-order corrections while continuing the eruption of an impacted canine. The combination of these two procedures reduces treatment time in the finishing stage.

TMA's low load-deflection rate allows less frequent reactivations, and its large range of activation means that tooth movement can proceed without frequent monitoring and appliance adjustments. Side effects can be effectively controlled by transferring the undesirable forces and moments to the anchorage built into the posterior segments. □

FIGURES

Fig. 1 A. Cantilever for mesial and vertical eruption of impacted canine. Angulation of ligature between cantilever and attachment on canine corresponds to line of force. B. Full-size rectangular archwire and transpalatal arch used for anchorage and space maintenance. C. Within four months, canine has erupted with proper tip, allowing engagement in continuous rectangular archwire.

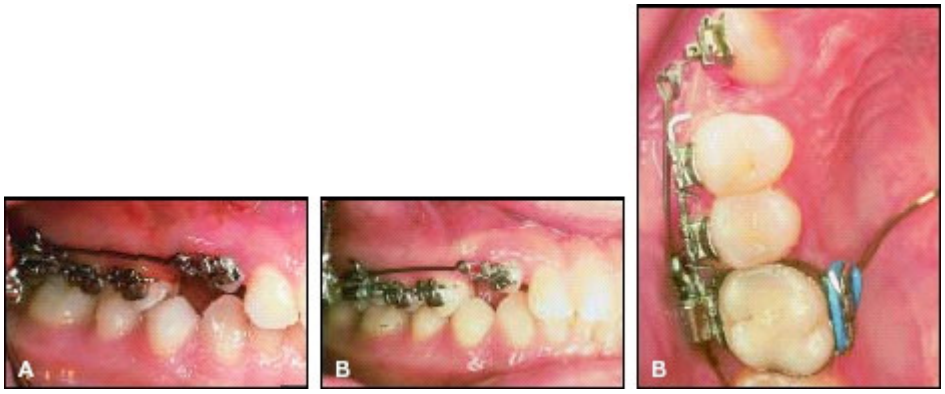

Fig. 2AB A. Cantilever for vertical eruption of impacted canine in adult patient. B. After one month of treatment, canine needs distal tipping, eruption, and mesial rotation.

Fig. 2C Sagittal plane: box loop activated by inserting it into canine bracket; distal tipping and extrusion achieved in one month.

Fig. 2D Horizontal plane: box loop activated for correcting canine rotation; mesial rotation achieved in one month.

Fig. 2E After appliance removal.

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FOOTNOTES

1 Registered trademark of Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.