

The K-9 Spring for Alignment of Impacted Canines

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Ectopic eruption and impaction of the maxillary permanent canines occurs in about 2% of orthodontic patients.¹⁻⁴ Impactions are twice as common in females as in males,⁵ and the incidence of palatal impactions is about two to three times that of labial impactions.^{6,7}

Extraction of an impacted canine may be the best treatment alternative in certain circumstances, but because of the unique functional and esthetic characteristics of the permanent canine,⁸ clinicians usually elect to bring an impacted canine into its proper position in the arch. Many techniques and appliance designs have been proposed for this purpose.⁹⁻¹⁹ The key factors are¹⁷:

- Application of a light, continuous force to move the canine.
- Initial vertical eruption of the canine—if necessary, away from the roots of the adjacent teeth—prior to buccal movement.

- Minimization of side effects.

This article describes a spring I have designed for eruption of palatally impacted canines in accordance with the above keys and with generally accepted principles of orthodontic appliance design.²⁰⁻²²

Fabrication and Activation

The K-9 spring is made of .017" × .025" TMA* wire, which can be activated twice as far as stainless steel before it undergoes permanent deformation, while producing less than half the force.

The horizontal arm of the spring is inserted into the first molar buccal tube and the premolar

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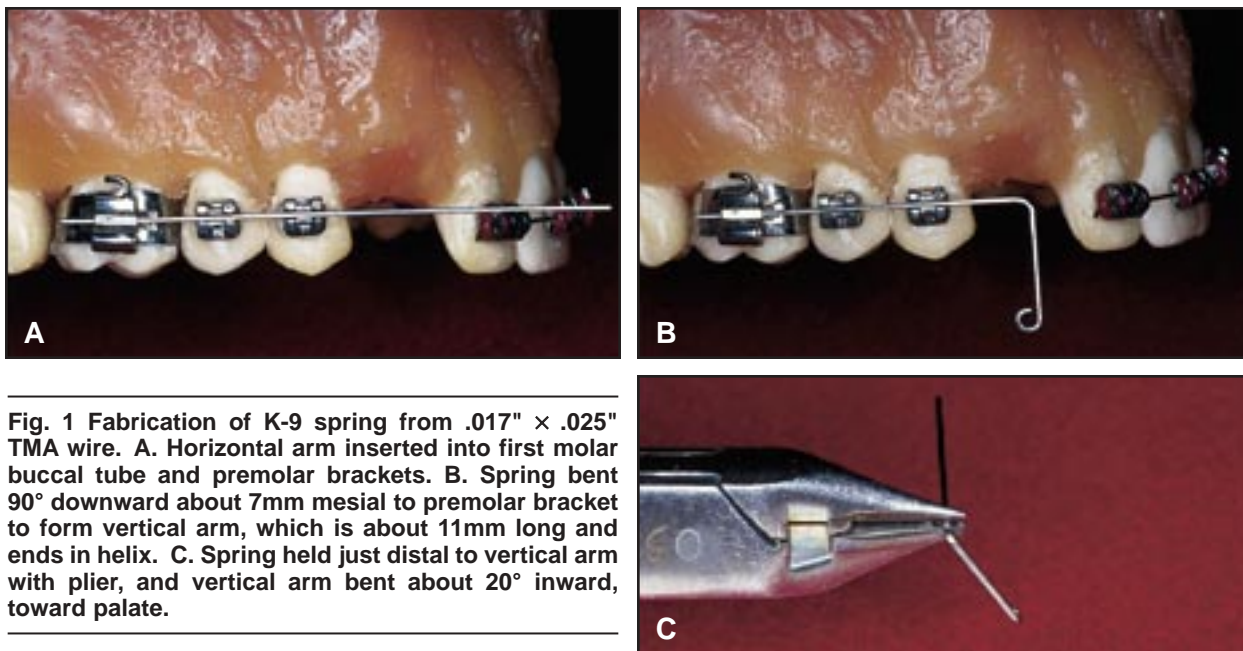


Fig. 1 Fabrication of K-9 spring from .017" × .025" TMA wire. A. Horizontal arm inserted into first molar buccal tube and premolar brackets. B. Spring bent 90° downward about 7mm mesial to premolar bracket to form vertical arm, which is about 11mm long and ends in helix. C. Spring held just distal to vertical arm with plier, and vertical arm bent about 20° inward, toward palate.



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brackets (Fig. 1A). About 7mm mesial to the first premolar bracket, the horizontal arm is bent 90° downward to form a vertical arm, which is about 11mm long and ends in a helix (Fig. 1B). While the spring is held with a plier just distal to the vertical arm, the vertical arm is bent about 20° inward, toward the palate (Fig. 1C).

To activate the spring after it is engaged in the buccal segment (Fig. 2A), the vertical arm is swung upward and ligated to the bonded attachment on the impacted canine (Fig. 2B), the vertical arm is swung upward and ligated to the bonded attach-

ment on the impacted canine (Fig. 2B). This provides a gentle extrusive force on the canine; the spring also has a buccal component of force due to the arcual pattern of activation and deactivation. The force needed to distalize the canine is achieved by cinching the spring back about 2mm after it has been ligated to the canine (Fig. 2C). Alternatively, the distalization force can be provided by bending the vertical arm distally prior to its ligation to the canine (Fig. 2D).

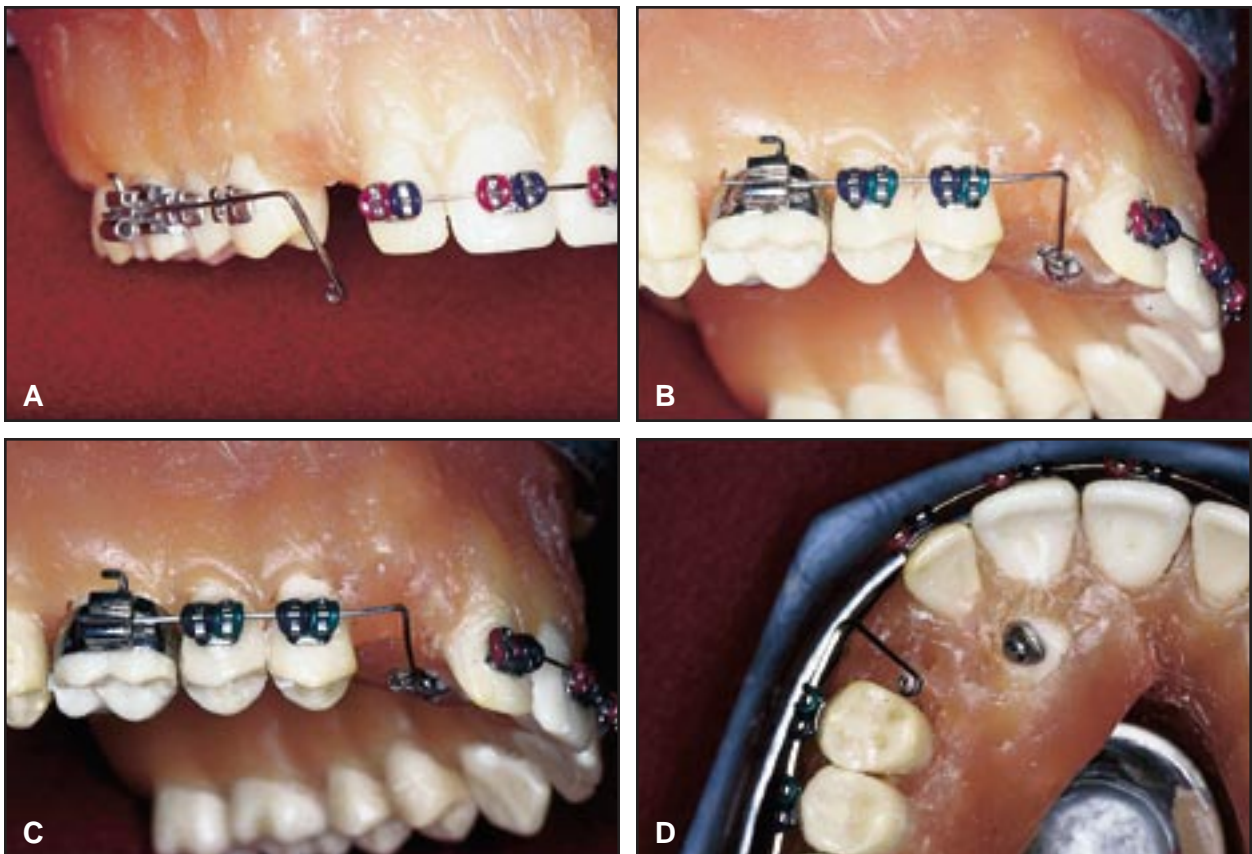


Fig. 2 Activation of K-9 spring. **A.** Spring engaged in buccal segment. **B.** Vertical arm swung upward and ligated to bonded attachment on impacted canine. **C.** Spring cinched back about 2mm to provide force needed to distalize canine. **D.** Alternative activation method: bending vertical arm distally before ligating it to canine.

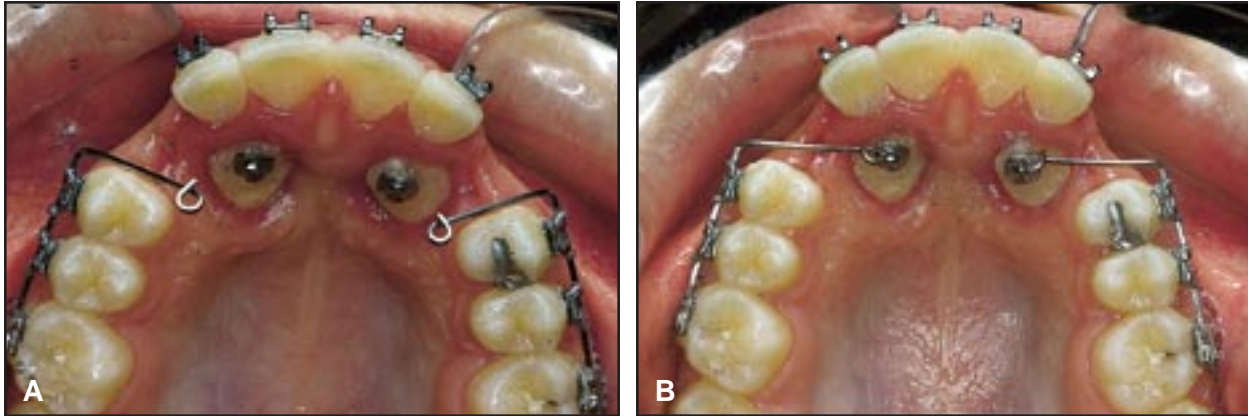


Fig. 3 Patient after surgical uncovering of canines and bonding of attachments. **A.** K-9 springs before activation. **B.** Springs ligated to canines.

Clinical Management

The sequence of treatment for bringing an impacted maxillary canine into the arch with the K-9 spring is:

1. The maxillary teeth (other than the impacted canine) are leveled and aligned with a continuous archwire from molar to molar.
2. An adequate amount of space is established for the impacted canine.
3. The impacted canine is surgically uncovered, and an attachment is bonded to it.
4. The continuous archwire is cut distal to the lateral incisor, and the buccal section is removed.
5. The K-9 spring is placed in the buccal segment and ligated to the impacted canine.

The spring's vertical component of force does not generally need reactivation during treatment. The distal component of force can be reactivated by cinching the spring back a little farther.

Figure 3 shows a patient with bilateral palatally impacted canines that were brought into the arch with K-9 springs. After the canine is surgically uncovered, the initial attachment is usually bonded on the more accessible lingual aspect of the crown. In most instances of high, palatally impacted canines, it takes two to four months to erupt and distalize the canine enough that it can be tied to the main archwire with a fine elas-

tomeric thread or tubing, which will bring it buccally into the arch. Once the facial aspect of the crown is visible, it may be necessary to bond an attachment to that surface as well (Fig. 4). This will allow the correct rotational moment to be applied to the canine while it is pulled buccally (Fig. 5).

When the vertical arm of the K-9 spring is rolled upward and inward to be engaged to a palatally impacted canine, the result is an intrusive force and a clockwise moment on the molar and premolars. A transpalatal arch can be used to control this reactive force and moment, but since the forces and moments exerted by the K-9 spring are quite low, any side effects on the buccal segment will be negligible, even without a transpalatal arch. In addition, one should bear in mind that when a canine is pulled distally with any form of mechanics, there is a mesial component of force exerted on the anchorage unit. Therefore, while pulling an impacted canine distally, adequate consideration must be given to the individual patient's anteroposterior anchorage requirements.

Conclusion

The K-9 spring is simple in design, low in cost, and easy to fabricate and activate. It is also comfortable for the patient and requires no spe-

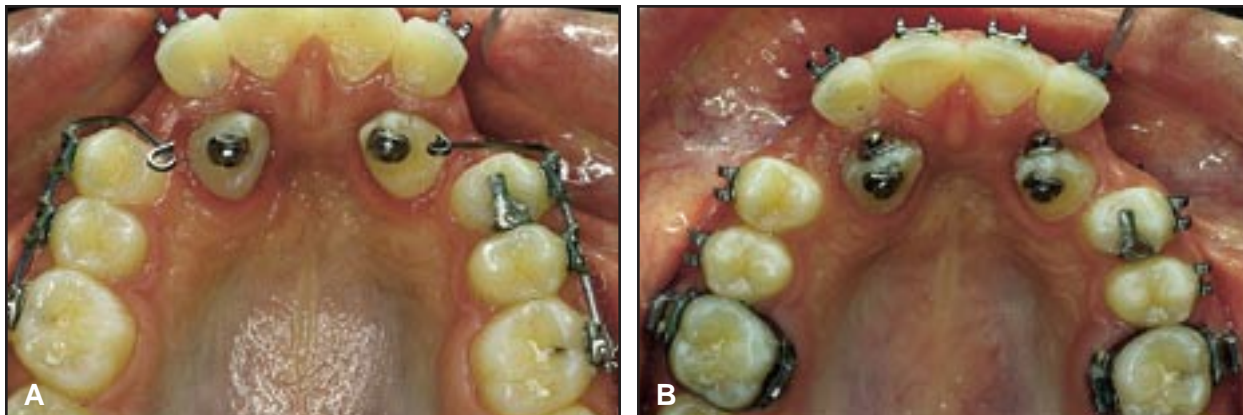


Fig. 4 A. Patient after eruption and distal and buccal movement of canines. **B.** Canines bonded with facial attachments.

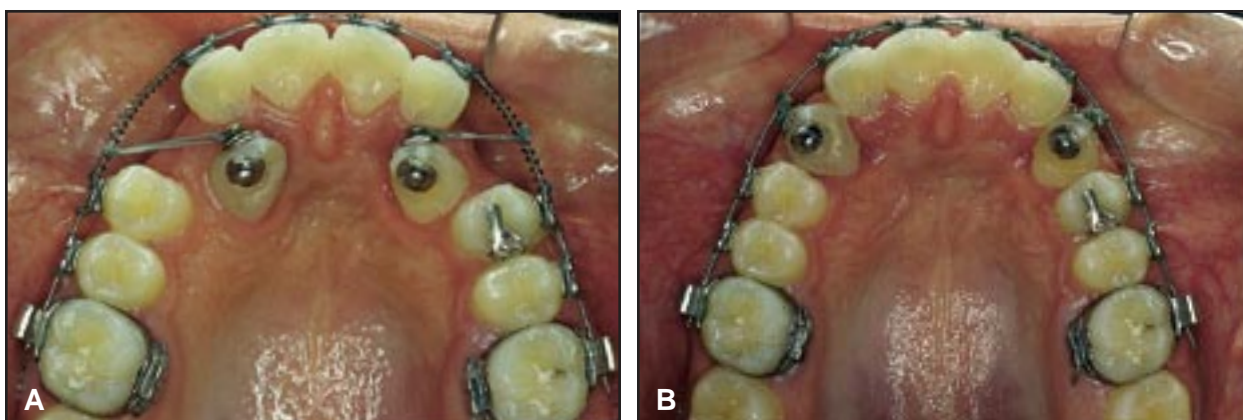


Fig. 5 A. Canines pulled buccally with fine elastomeric tubing tied to facial attachments. **B.** Canines in position within arch, prior to bonding brackets.

cial cooperation. The spring exerts a gentle and continuous eruptive and distalizing force on the impacted canine, with minimal side effects. In addition, due to its arcial pattern of activation and deactivation, the spring also provides a desirable buccal component of force on the impacted canine.

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