Forced Eruption of a Labially Impacted Canine Using Joined Micro-Implants

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Impaction of a maxillary canine is a common problem because of the tooth's long eruption path.[1] The canine sometimes erupts labial to the lateral incisor, occasionally causing resorption of the lateral incisor root.[2] In such a case, the lateral incisor can be extracted and the canine moved into its place (after changing the shape of the crown), but the yellowish color of the canine typically yields unacceptable results. Early detection of canine impaction is therefore of critical importance.

A labially impacted and transposed maxillary canine initially requires horizontal forces to move the canine crown away from the lateral incisor root. Attaching a sectional wire to the buccal surface of the first molar can cause loss of anchor-

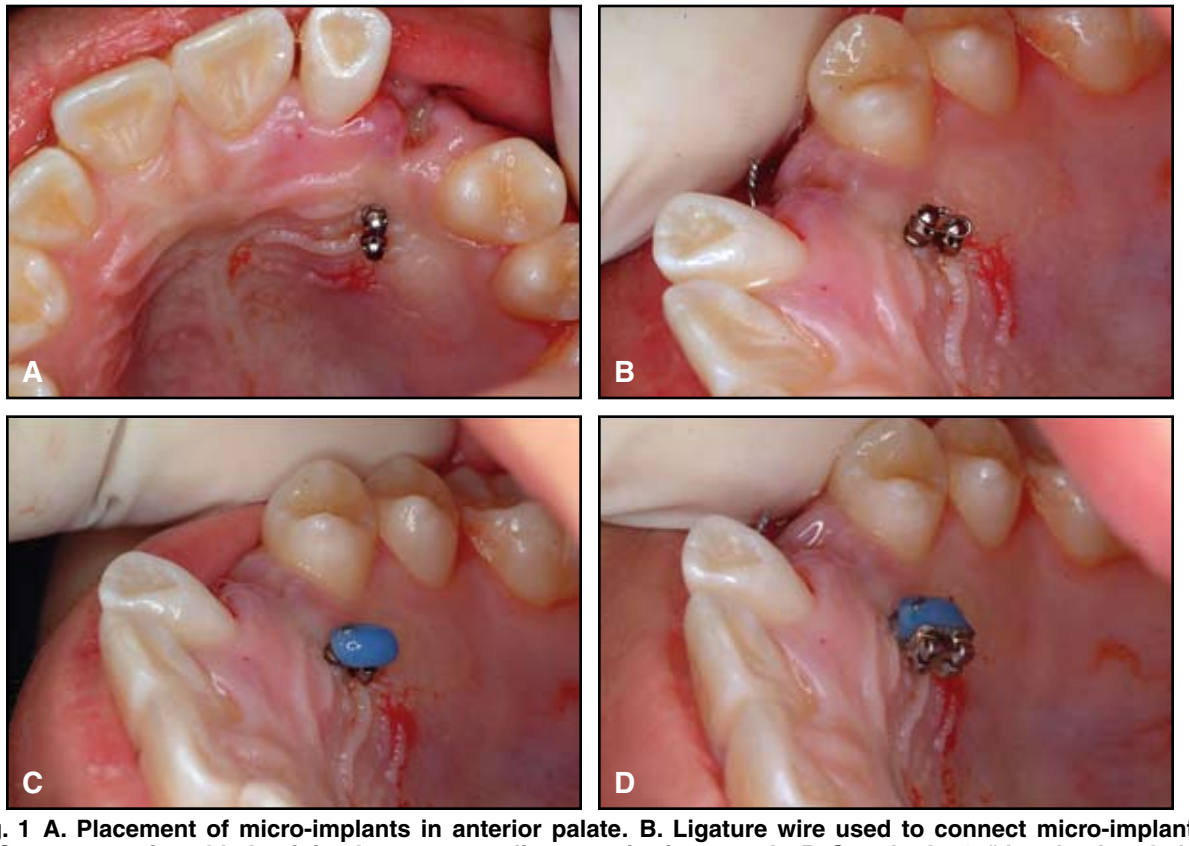

Fig. 1 A. Placement of micro-implants in anterior palate. B. Ligature wire used to connect micro-implants. C. Core composite added to joined screws over ligature wire framework. D. Standard .018" bracket bonded to composite.

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age and subsequent deterioration of the buccal occlusion. Once the canine crown has been moved distally enough to clear the lateral incisor, a vertical force is required to bring the canine into occlusion. Conventional fixed appliances make it difficult to change the force direction, and while removable appliances and elastics can move and control the impacted tooth in all three planes of space,[3] they require patient cooperation and may produce less precise dental alignment.

Skeletal anchorage, which provides a nearly stationary base, has become a routine treatment adjunct for many kinds of tooth movement.[4-6] Recently, micro-implants have been successfully used in the management of buccally impacted canines.[7] This article describes the application and advantages of skeletal anchorage from two joined micro-implants in the management of labially impacted canines.

Procedure

1. After surgical exposure of the canine crown, bond a lingual button to the crown surface, with a steel ligature wire extending distally. Suture the flap back over the crown.
2. Insert two micro-implants* in the anterior palate, parallel to each other and 2mm apart (Fig. 1A).
3. Connect the screws with a ligature wire to provide a rigid framework for the application of Bisfil Core** composite (Fig. 1B,C). Leave a space of about 1mm between the composite and the palatal soft tissue to allow for oral hygiene. Bond a standard .018" bracket to the composite in a position that allows easy access without causing patient discomfort (Fig. 1D).
4. Ligate a sectional wire to the bracket, and form a hook in the labial end of the wire for attachment to the emerging ligature, avoiding occlusal contact (Fig. 2). The direction of force can be modified by changing the position of the hook.

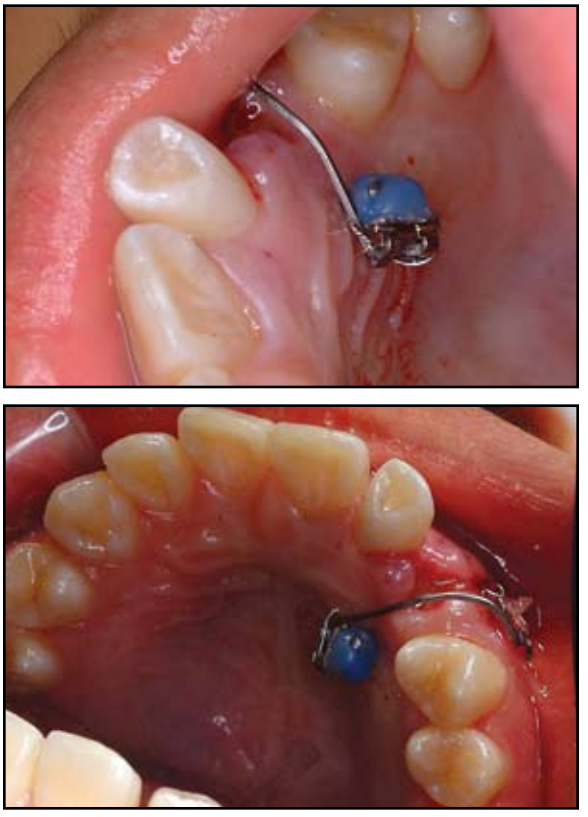

Fig. 2 Sectional wire attached to emerging ligature wire for distalization of canine.

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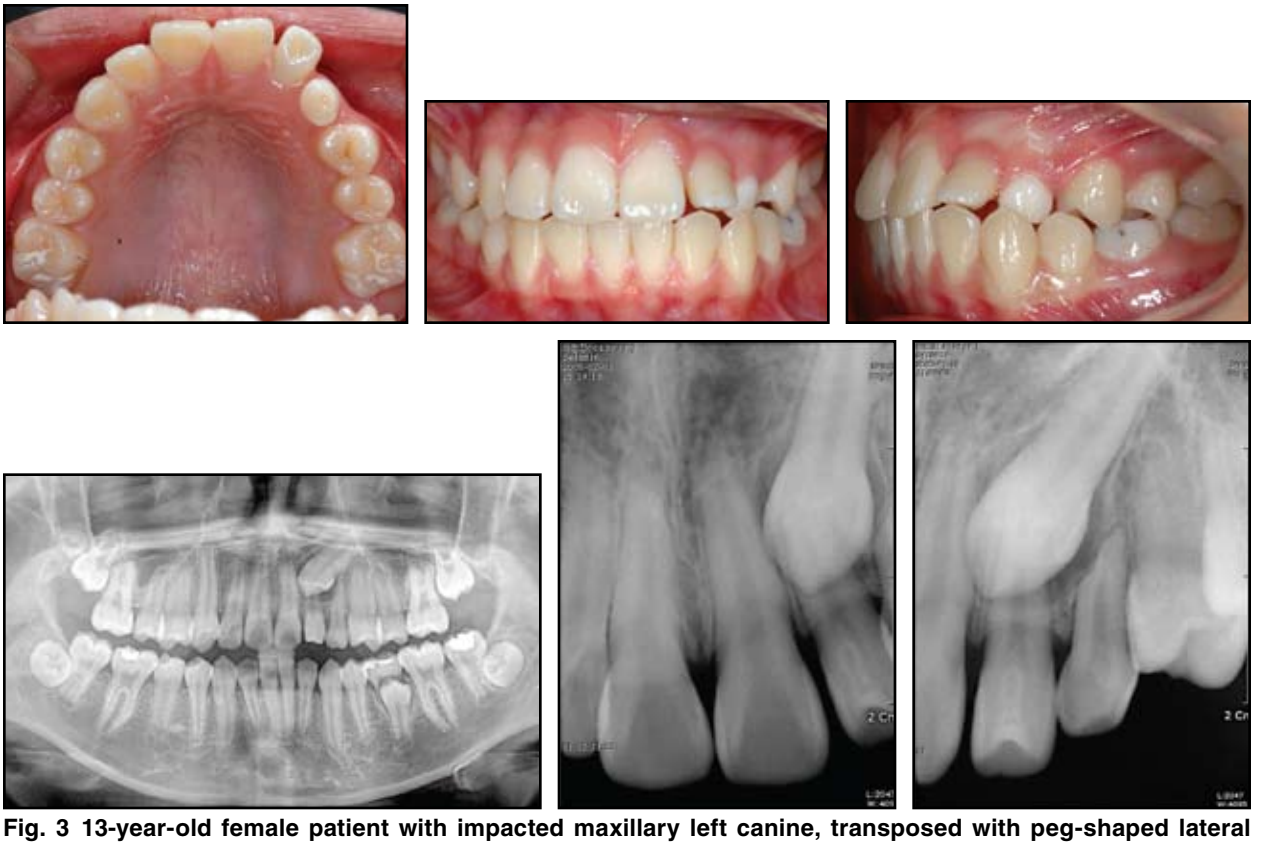

Fig. 3 13-year-old female patient with impacted maxillary left canine, transposed with peg-shaped lateral incisor.

Case Report

A 13-year-old female presented with an impacted and transposed upper left canine (Fig. 3). The left lateral incisor was in labioversion and had a peg-shaped crown. Radiographic examination confirmed the labial relationship of the impacted canine crown to the lateral incisor root. After surgical exposure of the canine, a button was bonded to the lingual surface (Fig. 4). Two micro-implants were placed in the anterior palate using the procedure described above, and a sectional wire was attached between the bracket over the joined micro-implants and the ligature wire extending from the impacted canine.

A horizontal distalizing force of 50g was applied with elastomeric chain from the hook on the sectional wire to the ligature extension (Fig. 5). After nine weeks of traction, the canine crown

Fig. 4 Lingual button bonded to lingual surface of crown after surgical exposure of canine.

Fig. 5 Force applied with elastomeric chain from hook on one end of sectional wire to ligature extension.

had been moved 5mm distally (Fig. 6A). The line of force was later changed to a more vertical-palatal direction by shortening the sectional wire (Fig. 6B). Another four weeks later, to pull the tip of the canine crown through the attached gingiva, the line of force was changed to a more occlusolingual direction (Fig. 6C). After exposure of the crown, seven weeks later, the lingual button was rebonded to the mesial surface of the crown, and occlusal forces were applied (Fig. 6D).

In another four weeks, enough of the labial

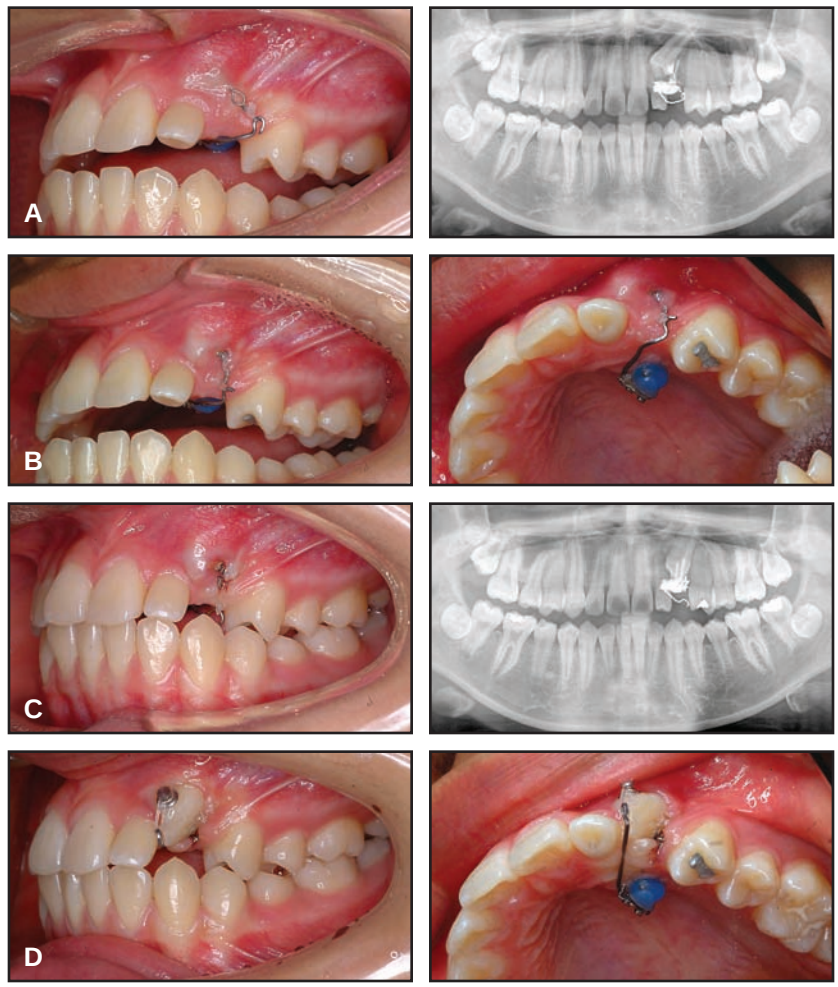

Fig. 6 A. Distal traction applied to canine. B. After 11 weeks, force changed to vertical direction by shortening sectional wire. C. After 15 weeks, force direction changed to occlusolingual direction to control canine crown tip. D. After 22 weeks, crown exposed and lingual button rebonded to mesial surface for application of occlusal forces.

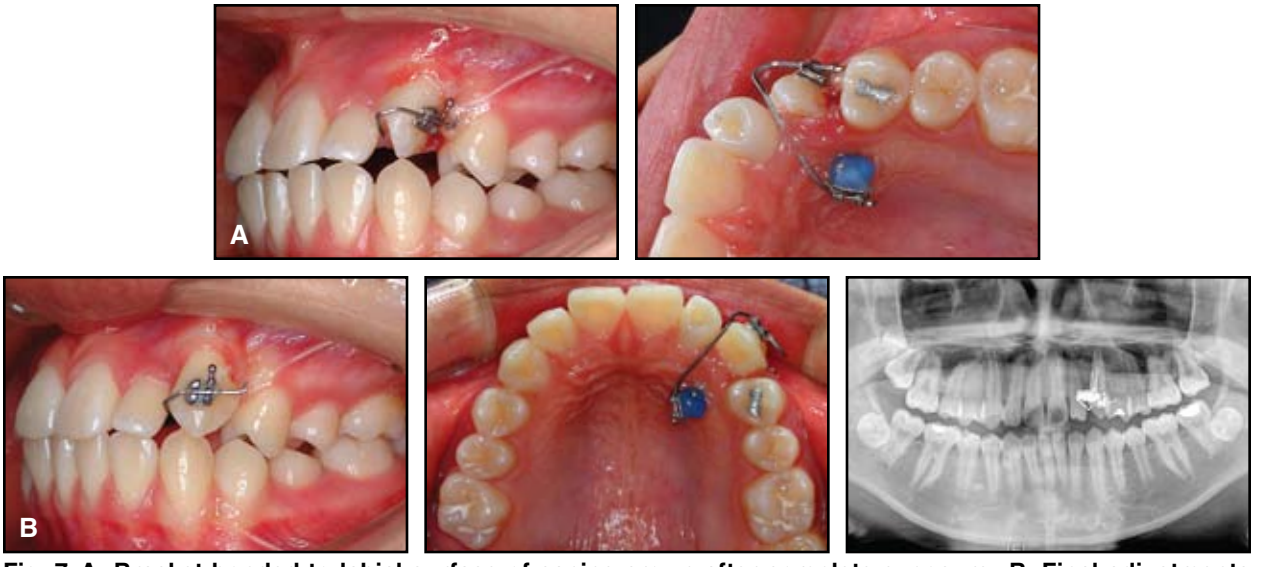

Fig. 7 A. Bracket bonded to labial surface of canine crown after complete exposure. B. Final adjustments made to hook on sectional wire for alignment of canine.

surface of the canine crown had been exposed to replace the lingual button with a bracket (Fig. 7A), and final alignment was performed with additional adjustment of the sectional wire (Fig. 7B).

After 11 months, the patient was forced to discontinue treatment for economic reasons (Fig. 8). The micro-implants were removed simply by unscrewing them.

Discussion

In the case shown here, two joined micro-implants provided reliable skeletal anchorage for forced eruption of an impacted and transposed maxillary canine. This technique offers a number of advantages, including minimal need for bracket bonding, avoidance of side effects on adjacent teeth, and ease of changing the force direction.

The midline should be avoided during micro-implant placement, given the proximity of the incisive canal, blood vessels, and nerves. The micro-implant should be 10-12mm long, with at least 6mm of the threaded portion embedded in the bone and the head clearly exposed from the mucosa. Because the palatal mucosa are less likely to become inflamed than the labial mucosa are, the success rate is generally higher using this placement site.[8,9]

In an adult patient, a single micro-implant with a slotted head could be used. In younger patients, early loading increases the risk of screw failure,[10] as does torsional force.[11] Therefore, a single micro-implant may not provide sufficient anchorage in adolescents, especially considering that the long arm of the sectional wire produces a large moment at the micro-implant.[12] Because mini- and micro-implants offer minimal resistance to torsional force,[11] complete osseointegration may be necessary.[13] As this article demonstrates, when immediate, heavy loading is required in an adolescent patient, connecting two micro-implants appears to be a successful option. Two joined micro-implants can withstand a larger moment because the stress is distributed over both screws, as confirmed by a study showing that a dental implant splinted to adjacent implants produced less peri-implant bone stress under a static horizontal load.[14]

To ensure eruption of the canine cusp through the attached gingiva, an apically positioned flap can be raised.[15] The attachment force

Fig. 8 Patient after removal of micro-implants following 11 months of treatment.

should be no greater than 50g, because the long moment arm may produce excessive torsional force. The direction of force can be precisely controlled in three dimensions by changing the position of the hook, thus avoiding damage to the roots of neighboring teeth.

The core composite we used to attach the bracket to the joined micro-implants is strong enough to withstand masticatory forces from food on the edentulous ridge,[16] and the anterior palate does not normally experience heavy forces of mastication. If the bracket does break off, however, another layer of composite can be added, a new bracket can be bonded, and a force can be immediately applied.

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