Tunnel Traction Procedure for Deeply Impacted Canines and Resorbed Lateral Incisors

ALDO GIANCOTTI, DDS, MS
GIANLUCA MAMPIERI, DDS, PhD
CLAUDIO ARCURI, MD, DDS

Three-dimensional radiographic studies have found root resorption in 38% of the lateral incisors and 23% of the central incisors associated with impacted canines.1-6 Although such damage can occur even when canines erupt normally,7,8 the key to success in treating an impacted canine is to achieve correct positioning in the dental arch without causing periodontal defects.9,10

A combined surgical-orthodontic approach called the tunnel traction procedure enables physiological eruption of a deeply impacted upper canine while preserving long-term periodontal health.11,12 Introduced by Crescini and colleagues, the technique is based on the concept of infracrestal guided eruption.1 It is recommended for use in cases where the corresponding deciduous teeth provide sufficient space for eruption of the impacted canines.

Fig. 1 Chain of 1.5mm-diameter wire rings made from .010” ligature wire and attached to anatomically contoured fine mesh.
Fig. 2 12-year-old male patient with Class II, division 1 malocclusion, deep overbite, and missing upper canines presenting with fixed appliances in both arches.
Tunnel Traction Procedure for Deeply Impacted Canines

Procedure

After extraction of the deciduous canine, a full-thickness flap is opened to expose the cortical plate, and the cortical bone is removed to provide access to the crown of the impacted permanent canine. A low-speed bur is inserted into the seat of the deciduous-canine root to drill a perforation into the bone under careful cool irrigation. The tunnel created by the perforation is used for infrabony traction to the crown of the impacted tooth.

A chain of 1.5mm-diameter wire rings is made from .010" ligature wire and attached to a bonded button, a bonded bracket base with a soldered ring, or an anatomically contoured fine mesh of the type used for periodontal splints (Fig. 1). The fine mesh is ideal for this situation because it can be adapted around the canine cusp for optimal traction through the tunnel. To prepare the mesh, a piece is shaped with a surgical scissor, and a perforation is made for attachment of the wire chain. The mesh and chain are passed through the osseous tunnel and attached as closely as possible to the center of the impacted canine crown. The flap is sutured in its original position, with the chain emerging from the socket of the deciduous tooth through the osseous tunnel.

The following case report illustrates the step-by-step procedure in a patient with deeply impacted canines and resorbed lateral incisors.

Case Report

A 12-year-old male presented with a Class II, division 1 malocclusion, a deep overbite, and missing upper canines. Both arches had previously been bonded with fixed appliances (Fig. 2). The upper and lower incisors were slightly retrusive, and the soft-tissue profile was concave, with retrusion of the lower lip. The maxillary midline was coincident with the facial and mandibular midlines. As confirmed by the panoramic x-ray, the upper canines were deeply impacted. Cone-beam computed tomography evidenced severe root resorption of the lateral incisors, with a poor prognosis in the long term. All third molars were developing, and there were no signs of active periodontal disease.

Three treatment options were considered. One was to maintain the upper lateral incisors, extract the first premolars, and guide the impacted canines into their proper positions. Another alternative was to extract the impacted canines, maintain the lateral incisors as long as possible, and, if necessary, eventually replace them with dental implants or prosthetic restorations. The third option, which was recommended and accepted, was to extract the compromised lateral incisors and guide the eruption of the impacted canines into the lateral-incisor positions, using the tunnel traction technique.

After extraction of the lateral incisors (Fig. 3), full-thickness flaps were raised (Fig. 4A), the cortical bone was removed (Fig. 4B), and the follicular sockets were eliminated as described above. A perforation was drilled into the bone at the position of each lateral-incisor root (Fig. 4C). Metal chains were prepared and attached to pieces of anatomically contoured fine mesh, which were passed through the osseous tunnels and affixed to the crowns of the impacted canines (Fig. 4D). The flap was then repositioned and sutured.
Fig. 4  A. Full-thickness flap raised to expose cortical plate.  B. Cortical bone resected to expose crown of impacted canine.  C. Bone drilled in lateral-incisor socket to create osseous tunnel.  D. Anatomically contoured fine mesh affixed to cusps of impacted canines; wire chains passed through osseous tunnels for traction.

Fig. 5  One week after surgery, elastic traction directed through each osseous tunnel toward center of alveolar ridge.
Fig. 6 After eight months of treatment, canines emerging at center of alveolar process.

The sutures were removed one week after surgery, and a force of about 70g was applied with elastic chain on each side, carefully maintaining the attached wire chain at the center of the socket while directing the elastic traction toward the center of the alveolar ridge (Fig. 5). The eruption of each impacted tooth was guided through the tunnel, between the internal and external cortical plates, so that the canine emerged at the center of the alveolar process (Fig. 6), within the area surrounded by keratinized gingiva (Fig. 7).

Treatment was completed in 24 months using preadjusted self-ligating brackets. The final records showed a good occlusion with normal overjet and overbite (Fig. 8). Special attention was paid to the gingival margins in an effort to achieve acceptable smile esthetics. After facial maturation, the patient is expected to undergo restorative treatment with veneers on the canines and premolars. Because of the unpredictability of long-term results, however, the patient and parents were informed of the potential need for orthodontic refinement before comprehensive restorative treatment.12,13

Discussion

Impacted canines adjoined by lateral incisors with severe root resorption require a careful, multi-disciplinary treatment plan and precise mechanics to achieve an acceptable outcome. Extraction of the permanent incisors, prolonged treatment, or both may be required, depending on the severity of the resorption.14,15 Three-dimensional localization of the impacted canines can be helpful in avoiding complications.4

Although the original indications for the
Fig. 8 Patient after 24 months of treatment.
tunnel traction technique included the persistence of the corresponding deciduous tooth,1 this case suggests another possibility: the presence of an adjacent lateral incisor with severe root resorption. After extracting the lateral incisor, the clinician can take advantage of the tunnel traction technique by connecting to the impacted canine through the extraction socket.

By allowing a physiological eruption pattern of the impacted canine at the center of the alveolar process, this technique promotes better periodontal health than can be achieved with a conventional approach, which may require the removal of a significant amount of cortical bone. It also avoids the expense and inconvenience of prosthetic implants, since the canines can substitute for the lateral incisors while the first premolars take the place of the canines.

REFERENCES