Attempted traction of impacted and ankylosed maxillary canines

Marlio Vinicius de Oliveira and Matheus Melo Pithon
Minas Gerais and Bahia, Brazil

The aim of this article is to report the clinical orthodontic treatment of an adult patient with 2 impacted maxillary canines. Traction was applied to the impacted teeth; however, after 7 months, the teeth were found to be ankylosed and were extracted. The extraction spaces were closed by moving the posterior teeth mesially with mini-implant anchorage. The results were satisfactory, with the premolars in the functional position of the canines. (Am J Orthod Dentofacial Orthop 2012;142:106-14)

The maxillary canines are important teeth in terms of esthetics and function. The likelihood of their failing to erupt or becoming impacted is between 1% and 3%. The causes of canine impaction can be correlated with other dental anomalies and could be due to local factors or a polygenetic, multifactorial inheritance. Local factors are tooth size-arch length discrepancies, prolonged retention or early loss of the deciduous canine, abnormal tooth bud position, alveolar cleft, dilaceration of the root, and idiopathic conditions with no apparent cause. This problem has several solutions.

The impacted tooth could be extracted, autotransplantation could be performed, or the tooth could be surgically exposed and orthodontically moved to another position in the dental arch. The timing of orthodontic treatment, the type of surgical procedure to expose the impacted tooth, the necessary orthodontic mechanics, and potential problems with treatment vary, depending on which tooth is impacted and its position in the jaw.

The objective of this case report is to describe the treatment of an adult with 2 impacted maxillary canines, which were diagnosed as ankylosed after the attempt to erupt them failed. This required extraction of the canines and orthodontic closure of the extraction spaces.

DIAGNOSIS AND ETIOLOGY

At the initial examination, the patient was aged 25 years 5 months and in a good state of general health. She was referred to the orthodontist for orthodontic treatment by her general dentist, who found the 2 impacted maxillary canines (Fig 1).

The patient had an Angle Class I malocclusion and an arch length discrepancy of −8.5 mm in the mandibular arch. Both maxillary canines were impacted, and the mandibular incisors were retroclined (1.NB, 16°). There were normal overlap and overbite, and quadrangular-shaped arches, with symmetry in the anteroposterior and transverse directions (Figs 1 and 2).

Radiographically, the impaction of the maxillary canines and mandibular third molars could be observed (Fig 3). The cephalometric radiograph showed a small skeletal disharmony in the sagittal direction, with an ANB angle equal to 0° (SNA, 84°; SNB, 84°). This showed a tendency for a skeletal Class III relationship. In the vertical plane of space, all cephalometric measurements indicated a well-balanced face (Go Gp-Sn, 30°; y-axis, 62°; FMA, 30°) (Figs 3 and 4).

The facial analysis showed a balanced and harmonious face, with lip seal at rest, a straight profile with a slight protrusion of the bottom lip (top lip, S-line, 0 mm; bottom lip, S-line, 2 mm) and an acceptable nasolabial angle (Figs 1 and 4).

TREATMENT OBJECTIVES

1. Maxilla: maintain the vertical, anteroposterior, and transverse positions.

3. Maxillary teeth: extract the deciduous canines and attempt traction of the impacted permanent canines. If the canines respond well to traction, it would be necessary to extract the first premolars. If the canines are ankylosed, they would be replaced by the first premolars.
Mandibular teeth: extract the first premolars to obtain space for alignment and leveling of the canines and the incisors. Maintain the retroclination of the incisors during treatment (1 NB, 16°).

5. Occlusion: establish proper canine occlusion, correct the mandibular crowding, obtain simultaneous bilateral contacts in harmony with centric relation, and disclude the posterior teeth in mandibular excursive movements.

6. Facial esthetics: in conjunction with the patient’s desires, the option was for treatment with extractions instead of orthognathic surgery, knowing the possibility of flattening the facial profile.

**TREATMENT ALTERNATIVES**

1. Orthosurgical treatment, with extraction of the maxillary first premolars to achieve better positioning of the maxillary incisors in addition to eruption and proper positioning of the maxillary canines.

2. Orthodontic treatment with extraction of the 4 first premolars and orthodontic repositioning of the maxillary canines.

3. Attempt traction of the maxillary left and right canines and maintain the maxillary left and right first premolars, without initially extracting them. If the canines responded to treatment favorably, the premolars would be extracted.

4. Treatment associated with extraction of all 4 first premolars.

**TREATMENT PROGRESS**

The patient declined orthognathic surgery because she had no esthetic complaints regarding her face.
Therefore, in conjunction with the patient, we decided to extract the 4 first premolars. The patient was informed with respect to the possible ankylosis of the maxillary canines and also that attempts to move them would lead to an increased treatment time. In the maxillary arch, initially only the deciduous canines were extracted, because if traction of the permanent canines was unsuccessful, the first premolars could replace them.

The plan was to place fixed orthodontic appliances in the maxillary and mandibular dental arches by using conventional edgewise brackets with 0.022 × 0.028-in slots, except for the mandibular incisors, which initially were not moved until there was space for aligning and leveling after partial retraction of the canines.

In the maxillary arch, stainless steel archwires, from 0.014 to 0.020 in, were used for alignment and leveling. After this, the maxillary deciduous canines were extracted, and surgical uncovering of the permanent canines was performed. A stainless steel arch was made of a rectangular section of 0.019 × 0.025-in archwire, with first- and third-order bends. Helical springs were welded between the lateral incisors and the first premolars, and a force of 100 g was applied to the canines (Fig 5). After 7 months of traction, opening of the bite in the incisor region was verified radiographically (Fig 6), and the canines were in the same position (Fig 7). Therefore, extraction of these teeth was requested, and the first premolars were used to replace them.

Orthodontic mini-implants were placed distally to the maxillary lateral incisors and were used to move the maxillary posterior teeth mesially (Fig 8). These served as added anchorage for the nickel-titanium springs. In the mandibular arch, partial retraction of the canines was performed with a segmented stainless steel archwire, 0.018 × 0.025 in, that was passive on the molars and premolars, with a T-loop between the canines and the second premolars. After partial retraction of the canines, round stainless steel archwires of 0.016 to 0.020 in were used, with box loops on the canines, to correct the root positions. By tying the molars and canines together, mesial inclination of their crowns was prevented. In the next phase, the incisors were bonded; stainless steel archwires of 0.014 to 0.020 in were made for alignment and leveling of all teeth.

In sequence, retraction arches of 0.019 × 0.025 in were used, with loops to retract the anterior teeth. In the maxillary arch, the loops were located between the lateral incisors and the first premolars. In the mandibular arch, they were located between the canines and the second premolars.

Maxillary and mandibular rectangular arches of 0.019 × 0.025 in were used to finalize the tooth positions, with first- and third-order bends according to the requirements of the teeth. After the active treatment phase, a removable maxillary circumferential retainer and a mandibular lingual bonded retainer were used to maintain the tooth positions.

**TREATMENT RESULTS**

The posttreatment records show a satisfactory treatment result (Figs 9-13).

1. Maxilla: there was a reduction of 1° in the SNA angle, probably due to alveolar remodeling, during retraction of the incisors. Its vertical and transverse positioning was maintained.
2. Mandible: the vertical, anteroposterior, and transverse positions were maintained.
3. Maxillary teeth: extraction of the permanent canines was necessary because they were ankylosed. The first premolars were used to replace the canines.
4. Mandibular teeth: space was obtained for aligning and leveling the incisors and canines by extraction of the first premolars. Incisor retroclination was maintained to enable adequate overlap and overbite, since the patient had a slight skeletal Class III (final ANB, −1°).
5. Occlusion: in the maxillary arch, the first premolars were positioned in the place of the canines. Ideal functional occlusion was obtained.
6. Facial esthetics: in spite of the slight deepening of the facial profile (top lip, S-line was reduced by 2 mm; bottom lip, S-line was reduced by 3 mm), facial esthetics were not compromised.

DISCUSSION

The maxillary canines are the most frequently impacted teeth (except for the third molars). According to Dewel,\(^5\) the maxillary canines have the longest development period, as well as the longest and most tortuous route from the point of formation to their final destination in full occlusion. Most clinicians agree that the permanent canines are essential for a functional occlusion, and that they play a major role in an attractive smile. For this reason, an orthodontist’s main task is to align impacted canines.\(^6\)

The prognosis of treatment in these patients depends on the position of the canine in relation to the adjacent teeth and their height in the alveolar process.\(^4\) One should also consider the possibility that the impacted canine will not move orthodontically. Then its extraction will be necessary, and the space could be occupied by the premolar or an implant or a pontic. The objective of this

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**Fig 5.** Intraoral photographs during the traction.

**Fig 6.** Intraoral photographs demonstrating intrusion of the maxillary teeth during the unsuccessful attempt to erupt the 2 maxillary canines.

**Fig 7.** Progress panoramic radiograph. The bite had opened, and the canines remained impacted.
The article is to describe the orthodontic treatment of a patient with 2 impacted maxillary canines that were ankylosed when an attempt was made to move them.

Before starting treatment to orthodontically move impacted teeth, it is always important for patients or their parents to be aware of the advantages and risks of treatment: ankylosis, loss of tooth vitality, resorption of the roots of the canine and adjacent teeth, loss of periodontal support, and a long treatment time. According to Cappellette et al., a canine in

**Fig 8.** Progress intraoral photographs. Mini-implants were placed distally to the maxillary lateral incisors and used to move the maxillary posterior teeth mesially.

**Fig 9.** Posttreatment photographs.
a patient between the ages of 13 and 19 years can frequently be brought into the arch by orthodontic traction after surgical exposure. In older patients, there is an increased risk that the impacted tooth could be ankylosed.

There are 3 techniques for accessing labially impacted maxillary canines: simply excising the gingiva, apical positioning of a gingival flap, and the closed-eruption technique.8 In our patient, the closed-eruption technique was chosen, because the crown of
the canine was well above the mucogingival line. The apically positioned flap technique was not selected, because it could result in reintrusion of the canine after orthodontic treatment and could also increase the possibility of gingival recession.

When extraction of a first premolar is indicated to obtain space for an impacted canine, it is advantageous to avoid extraction until the possibility of ankylosis or other problems—dilaceration or root resorption of the canine—have been assessed. In our patient, all of these precautions were taken. About 7 months after the attempt to move the impacted canines, we observed an opening of the bite caused by intrusion of the incisors. Radiographically, a false impression was gained that the canines had descended. However, in reality, the incisors had intruded. When this was identified, canine traction was suspended, and the patient was referred for extraction of the canines. During the surgery, the surgeon confirmed ankylosis of the canines because of the difficulty of extracting them; it was necessary to section these teeth to remove them.

It was important that the premolars were not prematurely extracted, so that they could be moved mesially with mini-implants that served as anchors. With the advent of orthodontic mini-implants, many situations that were previously difficult to resolve have become real possibilities. With these mechanics, mesial movement of the posterior teeth was achieved without retroclination of the incisors, which would have been unfavorable in this patient, because of her facial profile.

When the canines are replaced, the working excursion of the mandible must be in group function, since the premolar buccal cusp is often too short. In this patient, lateral discclusion was established with the maxillary first and second premolars contacting the mandibular canines and first premolars (Fig 14). When canines are replaced by premolars, previous research does not show evidence of periodontal problems in the long term.9

When we examined the radiographs at the end of treatment, there appeared to be proximity of the roots of the incisors. Some authors have suggested that adequate space between the roots of teeth at the bone-crest level is necessary for maintaining gingival health. Therefore, when roots are in close proximity, it results in thin interproximal bone, which could predispose the teeth to lose periodontal attachment more rapidly if the patient develops periodontal disease.10 A study that evaluated the incidence and distribution of root proximity after orthodontic treatment and also tested the hypothesis that areas with thin interdental bone septum are less resistant to periodontal disease than areas with normal bone dimensions between the roots of teeth concluded that there was no statistical difference in the quantity of gingival inflammation, attachment level, and bone level between the areas with close roots and the control areas. The results also showed that anterior teeth with close roots were not more subject to gingival recession than were teeth with adequate interradicular space.
CONCLUSIONS

With the procedures performed for this patient, the following can be concluded.

1. When the treatment plan involves orthodontic alignment of impacted canines, and it is necessary to extract premolars to obtain space, extraction should be delayed until after the impacted teeth have been successfully moved into the oral cavity.
2. Orthodontic mini-implants greatly facilitate mesial movement of posterior teeth.
3. The replacement of canines by premolars is a feasible alternative when there is ankylosis of the impacted canines.

REFERENCES